Philips Consumer Electronics

Technical Service Data

Service and Quality
Service Publications Dept.
One Philips Drive
P.O. Box 14810
Knoxville, TN 37914

Manual 7603
Model no.: 29LL600121
First Publish: 5-10-2001
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Pg. SCHEMATIC DIAGRAMS AND PC BOARDS

REFER TO SAFETY GUIDELINES

SAFETY NOTICE: ANY PERSON ATTEMPTING TO SERVICE THIS CHASSIS MUST FAMILIARIZE HIMSELF WITH THE CHASSIS AND BE AWARE OF THE NECESSARY SAFETY PRECAUTIONS TO BE USED WHEN SERVICING ELECTRONIC EQUIPMENT CONTAINING HIGH VOLTAGES.

CAUTION: USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING

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Safety Notes

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GENERAL SAFETY NOTES

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all Philips Consumer Electronics Company** equipment. The service procedures recommended by Philips and described in this service manual are effective methods of performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that this manual contains various **CAUTIONS** and **NOTICES** which should be carefully read in order to minimize the risk of personal injury to service personnel. The possibility exists that improper service methods may damage the equipment. It also is important to understand that these **CAUTIONS** and **NOTICES ARE NOT EXHAUSTIVE**. Philips could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Philips has not undertaken any such broad evaluation. Accordingly, a servicer who uses a service procedure or tool which is not recommended by Philips must first satisfy himself thoroughly that neither his safety nor the safe operation of the equipment will be jeopardized by the service method selected.

** Hereafter throughout this manual, Philips Consumer Electronics Company will be referred to as Philips.

WARNING

Critical components having special safety characteristics are identified with a ⚠ or **"S"** by the Ref. No. in the parts list and enclosed within a broken line* (where several critical components are grouped in one area) along with the safety symbol ⚠ on the schematics or exploded views. Use of substitute replacement parts which do not have the same specified safety characteristics may create shock, fire, or other hazards. Under no circumstances should the original design be modified or altered without written permission from Philips. Philips assumes no liability, express or implied, arising out of any unauthorized modification of design. Servicer assumes all liability.

- Broken Line _____ _ _____ _ _____ _ _____

SAFETY CHECKS

After the original service problem has been corrected, a complete safety check should be made. Be sure to check over the entire set, not just the areas where you have worked. Some previous servicer may have left an unsafe condition, which could be unknowingly passed on to Your customer. Be sure to check all of the following:

FIRE AND SHOCK HAZARD
IMPLOSION
X-RADIATION
LEAKAGE CURRENT COLD CHECK
LEAKAGE CURRENT HOT CHECK
PICTURE TUBE REPLACEMENT

FIRE AND SHOCK HAZARD

1. Be sure all components are positioned in such a way as to avoid the possibility of adjacent component shorts. This is especially important on those chassis which are transported to and from the service shop.

2. Never release a repaired unit unless all protective devices such as insulators, barriers, covers, strain reliefs, and other hardware have been installed in accordance with the original design.

3. Soldering and wiring must be inspected to locate possible cold solder joints, solder splashes, sharp solder points, frayed leads, pinched leads, or damaged insulation (including the ac cord). Be certain to remove loose solder balls and all other loose foreign particles.

4. Check across-the-line components and other components for physical evidence of damage or deterioration and replace if necessary. Follow original layout, lead length, and dress.

5. No lead or component should touch a receiving tube or a resistor rated at 1 watt or more. Lead tension around protruding metal surfaces or edges must be avoided.

6. Critical components having special safety characteristics are identified with an **'S'** by the Ref. No. in the parts list and enclosed within a broken line* (where several critical components are grouped in one area) along with the safety symbol  on the schematic diagrams and /or exploded views.

7. When servicing any unit, always use a separate isolation transformer for the chassis. Failure to use a separate isolation transformer may expose you to possible shock hazard, and may cause damage to servicing instruments.

8. Many electronic products use a polarized ac line cord (one wide pin on the plug). Defeating this safety feature may create a potential hazard to the servicer and the user. Extension cords which do not incorporate the polarizing feature should never be used.

9. After reassembly of the unit, always perform an **ac leakage test** or resistance test from the line cord to all exposed metal parts of the cabinet. Also, check all metal control shafts (with knobs removed), antenna terminals, handles, screws, etc., to be sure the unit may be safely operated without danger of electrical shock.

*** Broken line** ____ _ ____ _ ____ _ ____

IMPLOSION

1. All picture tubes used in current model receivers are equipped with an integral implosion system. Care should always be used, and safety glasses worn, whenever handling any picture tube. Avoid scratching or otherwise damaging the picture tube during installation.

2. Use only replacement tubes specified by the manufacturer.

X-RADIATION

1. Be sure procedures and instructions to all your service personnel cover the subject of X-radiation. Potential sources of X-rays in TV receivers are the picture tube and the high voltage circuits. The basic precaution which must be exercised is to keep the high voltage at the factory recommended level.

2. To avoid possible exposure to X-radiation and electrical shock, only the manufacturer's specified anode connectors must be used.

3. It is essential that the service technician has an accurate HV meter available at all times. The calibration of this meter should be checked periodically against a reference standard.

4. When the HV circuitry is operating properly there is no possibility of an X-radiation problem. High voltage should always be kept at the manufacturer's rated value - no higher - for optimum performance. Every time a color set is serviced, the brightness should be run up and down while monitoring the HV with a meter to be certain that the HV is regulated correctly and does not exceed the specified value. We suggest that you and your technicians review test procedures so that HV and HV regulation are always checked as a standard servicing procedure, and the reason for this prudent routine is clearly understood by everyone. It is important to use an accurate and reliable HV meter. It is recommended that the HV reading be recorded on each customer's invoice, which will demonstrate a proper concern for the customer's safety.

5. When troubleshooting and making test measurements in a receiver with a problem of excessive high voltage, reduce the line voltage by means of a Variac to bring the HV into acceptable limits while troubleshooting. Do not operate the chassis longer than necessary to locate the cause of the excessive HV.

6. New picture tubes are specifically designed to withstand higher operating voltages without creating undesirable X-radiation. It is strongly recommended that any shop test fixture which is to be used with the new higher voltage chassis be equipped with one of the new type tubes designed for this service. Addition of a permanently connected HV meter to the shop test fixture is advisable. The CRT types used in these new sets should never be replaced with any other types, as this may result in excessive X-radiation.

7. It is essential to use the specified picture tube to avoid a possible X-radiation problem.

8. Most TV receivers contain some type of emergency "Hold Down" circuit to prevent HV from rising to excessive levels in the presence of a failure mode. These various circuits should be understood by all technicians servicing them, especially since many hold down circuits are inoperative as long as the receiver performs normally.

LEAKAGE CURRENT COLD CHECK

1. Unplug the ac line cord and connect a jumper between the two prongs of the plug.

2. Turn on the power switch.

3. Measure the resistance value between the jumpered ac plug and all exposed cabinet parts of the receiver, such as screw heads, antennas, and control shafts. When the exposed metallic part has a return path to the chassis, the reading should be between 1 megohm and 5.2 megohms. When the exposed metal does not have a return path to the chassis, the reading must be infinity. Remove the jumper from the ac line cord.

LEAKAGE CURRENT HOT CHECK

1. Do not use an isolation transformer for this test. Plug the completely reassembled receiver directly into the ac outlet.

2. Connect a **1.5k, 1OW resistor** paralleled by a **0.15uF. capacitor** between each exposed metallic cabinet part and a **good earth ground** such as a water pipe, as shown below.

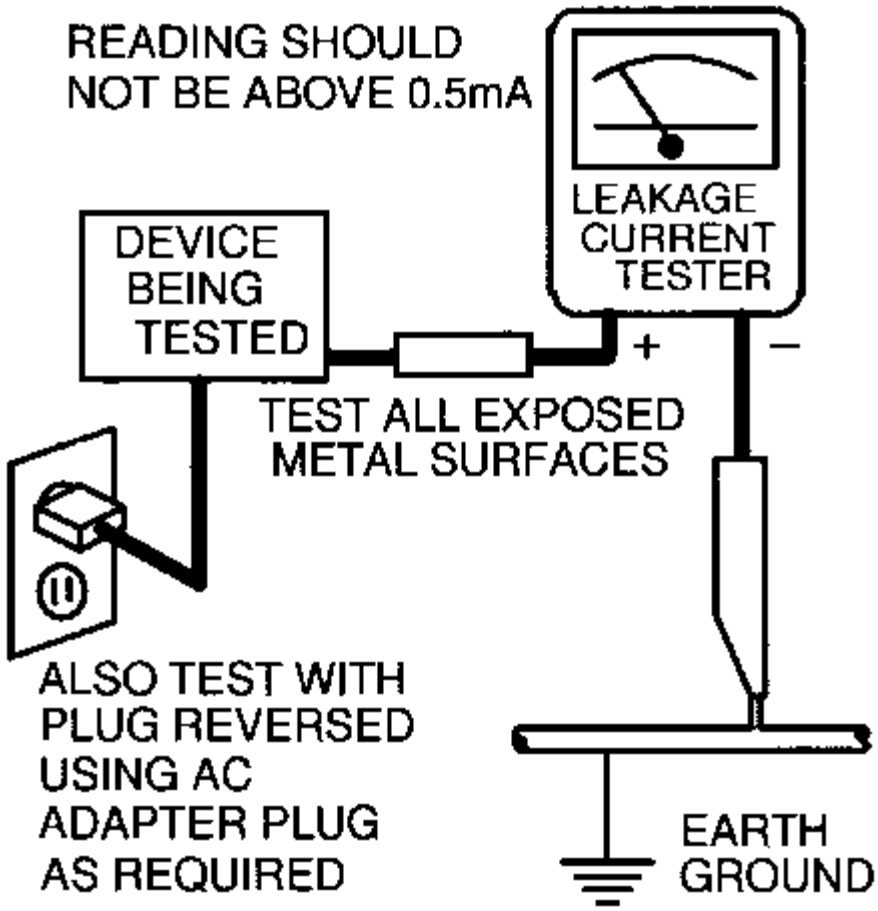
3. Use an ac voltmeter with at least 5000 ohms/volt sensitivity to measure the potential across the resistor.

4. The potential at any point should not exceed 0.75 volts**.** A leakage current tester may be used to make this test; leakage current must not exceed 0.5milliamp. If a measurement is outside of the specified limits, there is a possibility of shock hazard. The receiver should be repaired and rechecked before returning it to the customer.

5**. Repeat the above procedure with the ac plug reversed.** (Note: An ac adapter is necessary when a polarized plug is used. Do not defeat the polarizing feature of the plug.)

OR

With the instrument completely reassembled, plug the AC line cord directly into a 120V AC outlet. **(Do not use an isolation transformer during this test.)** Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.1 Leakage Current for Appliances and Underwriters Laboratories (UL) 1410, (50.7). **With the instrument AC switch first in the on position and then in the off position, measure from a known earth ground (metal water pipe, conduit, etc.) to all exposed metal parts of the instrument (antennas, handle brackets, metal cabinet, screw heads, metallic overlays, control shafts, etc.), especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 0.5 milliamp. Reverse the instrument power cord plug in the outlet and repeat the test. See graphic below.**



PICTURE TUBE REPLACEMENT

The primary source of X-radiation in this television receiver is the picture tube. The picture tube utilized in this chassis is specially constructed to limit X-radiation emissions. For continued X-radiation protection, the replacement tube must be the same type as the original, including suffix letter, or a Philips approved type.

PARTS REPLACEMENT

Many electrical and mechanical parts in Philips television sets have special safety related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. The use of a substitute part which does not have the same safety characteristics as the Philips recommended replacement part shown in this service manual may create shock, fire, or other hazards

TV SAFETY NOTES

SAFETY CHECKS
IMPLOSION

X-RADIATION
PICTURE TUBE REPLACEMENT
PARTS REPLACEMENT

WARNING

Before removing the CRT anode cap, turn the unit **OFF** and short the **HIGH VOLTAGE** to the **CRT DAG** ground.

SERVICE NOTE: The **CRT DAG** is not at chassis ground.

TV-VCR COMBI SAFETY NOTES

IMPORTANT SAFETY PRECAUTIONS

Prior to shipment from the factory, our products are strictly inspected for recognized product safety and electrical codes of the countries in which they are to be sold. However, in order to maintain such compliance, it is equally important to implement the following precautions when a set is being serviced.

SAFETY PRECAUTIONS FOR TV CIRCUITS

1. Before returning an instrument to the customer, always make a safety check of the entire instrument, including, but not limited to, the following items:

   a. Be sure that no built-in protective devices are defective or have been defeated during servicing. (1) Protective shields are provided on this chassis to protect both the technician and the customer. Correctly replace all missing protective shields, including any removed for servicing convenience. (2) When reinstalling the chassis and/or other assembly in the cabinet, be sure to put back in place all protective devices, including but not limited to, nonmetallic control knobs, insulating fishpapers, adjustment and compartment covers/shields, and isolation resistor/capacitor networks. Do not operate this instrument or permit it to be operated without all protective devices correctly installed and functioning. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damage.

   b. Be sure that there are no cabinet openings through which an adult or child might be able to insert their fingers and contact a hazardous voltage. Such openings include, but are not limited to, (1) spacing between the picture tube and the cabinet mask, (2) excessively wide cabinet ventilation slots, and (3) an improperly fitted and/or incorrectly secured cabinet back cover.

   c. Do a **LEAKAGE CURRENT CHECK**

   ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE INSTRUMENT TO THE CUSTOMER OR BEFORE CONNECTING THE ANTENNA OR ACCESSORIES.

d. **X-Radiation and High Voltage Limits** - Because the picture tube is the primary potential source of X-radiation in solid-state TV receivers, it is specially constructed to prohibit X-radiation emissions. For continued X-radiation protection, the replacement picture tube must be the same type as the original. Also, because the picture tube shields and mounting hardware perform an X-radiation protection function, they must be correctly in place. High voltage must be measured each time servicing is performed that involves B+, horizontal deflection or high voltage. Correct operation of the X-radiation protection circuits also must be reconfirmed each time they are serviced. (X-radiation protection circuits also may be called "horizontal disable" or "hold down.") Read and apply the high voltage limits and, if the chassis is so equipped, the X-radiation protection circuit specifications given on instrument labels and in the **Product Safety & X-Radiation** Warning note on the service data chassis schematic. High voltage is maintained within specified limits by close tolerance safety-related components/adjustments in the high-voltage circuit. If high voltage exceeds specified limits, check each component specified on the chassis schematic and take corrective action.

2. Read and comply with all caution and safety-related notes on or inside the receiver cabinet, on the receiver chassis, or on the picture tube.

3. **Design Alteration Warning** - Do not alter or add to the mechanical or electrical design of this TV receiver. Design alterations and additions, including, but not limited to circuit modifications and the addition of items such as auxiliary audio and/or video output connections, might alter the safety characteristics of this receiver and create a hazard to the user. Any design alterations or additions will void the manufacturer's warranty and may make you, the servicer, responsible for personal injury or property damage resulting therefrom.

4**. Picture Tube Implosion Protection Warning** - The picture tube in this receiver employs integral implosion protection. For continued implosion protection, replace the picture tube only with one of the same type number. Do not remove, install, or otherwise handle the picture tube in any manner without first putting on shatterproof goggles equipped with side shields. People not so equipped must be kept safely away while picture tubes are handled. Keep the picture tube away from your body. Do not handle the picture tube by its neck. Some "in-line" picture tubes are equipped with a permanently attached deflection yoke; because of potential hazard, do not try to remove such "permanently attached" yokes from the picture tube.

5. **Hot Chassis Warning**

a. Some TV receiver chassis are electrically connected directly to one conductor of the ac power cord and may be serviced safely without an isolation transformer only if the ac power plug is inserted so that the chassis is connected to the ground side of the ac power source. To confirm that the ac power plug is inserted correctly, with an ac voltmeter, measure between the chassis and a known earth ground. If a voltage reading in excess of 1.OV is obtained, remove and reinsert the ac power plug in the opposite polarity and again measure the voltage potential between the chassis and a known earth ground.

b. Some TV receiver chassis normally have 85Vac (RMS) between chassis and earth ground regardless of the ac plug polarity. This chassis can be safety-serviced only with an isolation transformer inserted in the power line between the receiver and the ac power source, for both personnel and test equipment protection. Some TV receiver chassis have a secondary ground system in addition to the main chassis ground. This secondary ground system is not isolated from the ac power line. The two ground systems are electrically separated by insulation material that must not be defeated or altered.

6. Observe original lead dress. Take extra care to assure correct lead dress in the following areas: **a.** near sharp edges, **b.** near thermally hot parts - be sure that leads and components do not touch

thermally hot parts, **c.** the ac supply, **d.** high voltage, and **e.** antenna wiring. Always inspect in all areas for pinched, out of place, or frayed wiring. Check ac power cord for damage.

7. Components, parts, and/or wiring that appear to have overheated or are otherwise damaged should be replaced with components, parts, or wiring that meet original specifications. Additionally, determine the cause of overheating and/or damage and, if necessary, take corrective action to remove any potential safety hazard.

PRECAUTIONS DURING SERVICE

A. Parts identified by the ⚠ symbol are critical for safety. Replace only with part number specified.

B. In addition to safety, other parts and assemblies are specified for conformance with regulations applying to spurious radiation. These must also be replaced only with specified replacements.
Examples: RF converters, RF cables, noise blocking capacitors, and noise blocking filters, etc.

C. Use specified internal wiring. Note especially:
1) Wires covered with PVC tubing
2) Double insulated wires
3) High voltage leads

D. Use specified insulating materials for hazardous live parts. Note especially:
1) Insulation Tape
2) PVC tubing
3) Spacers
4) Insulators for transistors

E. When replacing ac primary side components (transformers, power cord, etc.), wrap ends of wires securely about the terminals before soldering.

F. Observe that the wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.)

G. Check that replaced wires do not contact sharp edged or pointed parts.

H. When a power cord has been replaced, check that 10-15 kg of force in any direction will not loosen it.

I. Also check areas surrounding repaired locations.

J. Use care that foreign objects (screws, solder droplets, etc.) do not remain inside the set.

K**. Crimp type wire connector**
When replacing the power transformer in sets where the connections between the power cord and power transformer primary lead wires are performed using crimp type connectors, in order to prevent shock hazards, perform carefully and precisely the following steps.

Replacement procedure
1) Remove the old connector by cutting the wires at a point close to the connector. **Important:** Do not re-use a connector (discard it).

2) Strip about 15 mm of the insulation from the ends of the wires. If the wires are stranded, twist the strands to avoid frayed conductors.
3) Align the lengths of the wires to be connected. Insert the wires fully into the connector.
4) Use the crimping tool to crimp the metal sleeve at the center position. Be sure to crimp fully to the complete closure of the tool.

L. When connecting or disconnecting the VCR connectors, first, disconnect the ac plug from the ac supply socket.

SAFETY CHECK AFTER SERVICING

Examine the area surrounding the repaired location for damage or deterioration. Observe that screws, parts and wires have been returned to original positions. Afterwards, perform the following tests and confirm the specified values in order to verify compliance with safety standards.

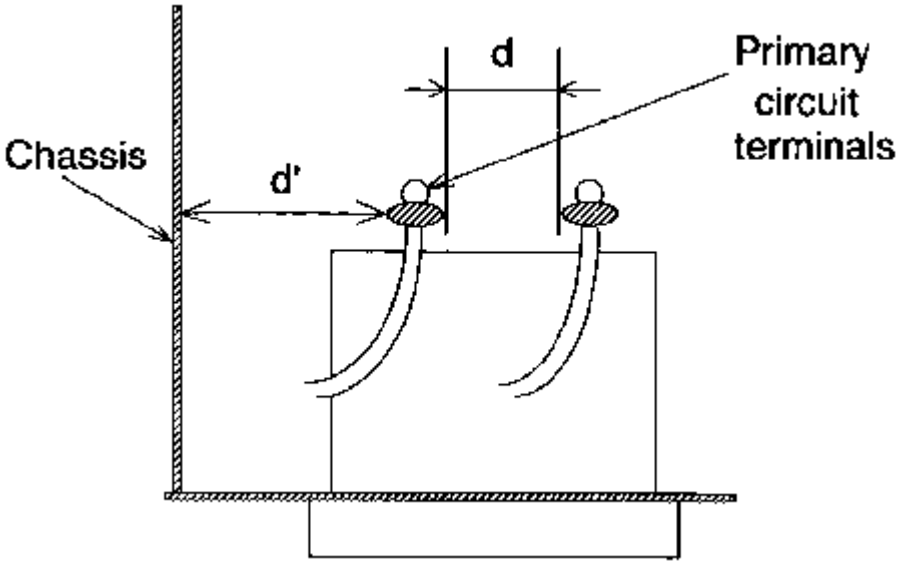
1. **Clearance Distance**

When replacing primary circuit components, confirm specified clearance distance (d) and (d') between soldered terminals, and between terminals and surrounding metallic parts. (See graphic bllow)

Table 1 : Ratings for selected area

AC Line Voltage	Region	Clearance Distance (d) (d')
110 to 130 V	USA or CANADA	> 3.2 mm (0.126 inches)

Note: This table is unofficial and for reference only. Be sure to confirm the precise values.



2. **LEAKAGE CURRENT CHECKS**

VCR SAFETY NOTES

FIRE & SHOCK HAZARD (VCR)

1. Be sure that all components are positioned in such a way to avoid possibility of shorts to adjacent components. This is especially important on those chassis which are transported to and from the repair shop.

2. Always replace all protective devices such as insulators and barriers after working on a set.

3. Check for damaged insulation on wires including the ac cord.

4. Check across-the-line components for damage and replace if necessary.

5. After re-assembly of the unit, always perform an ac leakage test on the exposed metallic parts of the cabinet such as the knobs, antenna terminals, etc. to be sure the set is safe to operate without danger of electrical shock. **Do not use a line isolation transformer during this test.** Use an ac voltmeter having 5000 ohms per volt or more sensitivity in the following manner: Connect a 1500 ohm 10 wan resistor, paralleled by 0.15 MFD ac type capacitor, between a known good earth ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the ac voltage across the combination 1500 ohm resistor and 0.15 MFD capacitor. Reverse the ac plug on the set and repeat ac voltage measurements again for each exposed metallic part. Voltage measured must not exceed O.6 volts R.M.S. This corresponds to 0.4 milliamp ac. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.

GENERAL

Power Supply-This receiver is designed for operation on 120 Volts, 6OHz alternating current (ac) only. Never connect to a supply having a different frequency or voltage.

IMPORTANT NOTICE

This device employs many circuits, components, and mechanical parts designed for protection against fire, shock and RF interference. For continued safety any servicing should be performed by qualified personnel and exact replacement parts should be used. Under no circumstances should the original design be altered.

PRODUCT SAFETY GUIDELINES FOR ALL PRODUCTS

CAUTION: Do not modify any circuit. Service work should be performed only after you are thoroughly familiar with all of the following safety checks. Risk of potential hazards and injury to the user increases if safety checks are not adhered to.
USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING.

PREVENTION OF ELECTROSTATIC DISCHARGE (ESD)

Some semiconductor solid state devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices, Examples of typical ES devices are integrated circuits and some field-effect transistors and semiconductor "chip" components. The following techniques should be used to help reduce the incidence of component damage caused by electrostatic discharge (ESD).

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any ESD on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging ESD wrist strap, which should be removed for potential shock reasons prior to applying power to the unit under test.

2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge buildup or exposure of the assembly.

3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.

4. Use only an anti-static solder removal device. Some solder removal devices not classified as "antistatic (ESD protected)" can generate an electrical charge sufficient to damage ES devices.

5. Do not use freon·propelled chemicals. These can generate electrical charges sufficient to damage ES devices.

6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive material).

7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.

CAUTION : Be sure no power is applied to the chassis or circuit and observe all other safety precautions.

8. Minimize bodily motions when handling unpackaged replacement ES devices. (Otherwise harmless motion such as the brushing together of your clothes fabric or the lifting of your feet from a carpeted floor can generate static electricity (ESD) sufficient to damage an ES device.)

NOTE to CATV system Installer:
This reminder is provided to call the CATV system installer's attention to article 820-22 of the NEC that provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as practical.

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Mechanical Diagrams

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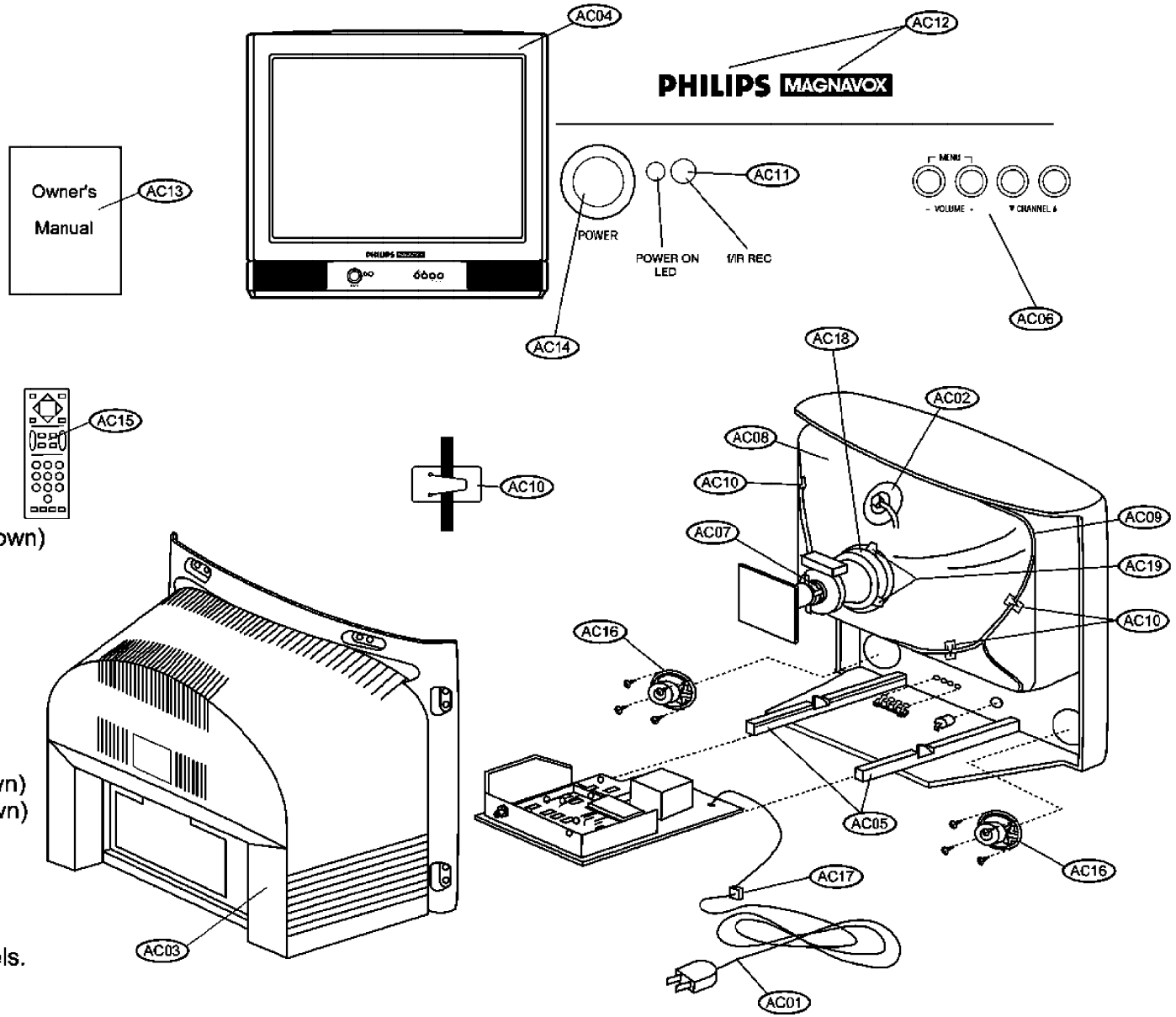
TYPICAL TABLE MODEL EXPLODED VIEW

REF.		DESCRIPTION
AC01	⚠	AC Power Cord
AC02	⚠	Anode Clip
AC03		Cabinet Back
AC04		Cabinet Front
AC05		Chassis Guide
AC06		Control Buttons
AC07	⚠	Convergence and Purity Assembly
AC08	⚠	CRT
AC09	⚠	Degaussing Coil
AC10		Degaussing Coil Holder (4 Used)
AC11		Light Guide
AC12		Nameplate
AC13		Owner's Manual
AC14		Power Button
AC15		Remote Transmitter
AC16		Speaker
AC17		Strain Relief for AC Cord
AC18	⚠	Yoke
AC19		Yoke Wedge
AC20		AC Adaptor (Not Shown)
AC21		Batteries for Remote Transmitter (Not Shown)
AC22		Card Door Cover (Not Shown)
AC23		Card Housing (Not Shown)
AC24		Degaussing Coil Spring (Not Shown)
AC25		Instruction Sheet (Not Shown)
AC26		Jack Panel, Plastic (Not Shown)
AC27		OCV Card Door Cover (Not Shown)
AC28		RF Cable (Not Shown)
AC29		Vent Cover (Not Shown)
AC30		**Extra Power Supply Bracket (Not Shown)**
AC31		**Extra Power Supply Module (Not Shown)**
AC32		**Assembly Braid (Not Shown)**
AC33		**Cabinet Door (Not Shown)**

Note: Some parts listed are not available in all models.



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Troubleshooting

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Test Points

The chassis is equipped with test points printed on the circuit board assemblies. These test points refer to the functional blocks:

Test point	Cuircuit	Diagram
A1-A2-A3-..	Audio processing	A8, A9 / A11
C1-C2-C3-..	Control	A7
F1-F2-F3-..	Frame drive and output	A3
I1-I2-I3-..	Tuner & IF	A4
L1-L2-L3-.	Line drive and output	A2
P1-P2-P3-..	Power supply	A1
S1-S2-S3-..	Synchronisation	A6
V1-V2-V3-..	Video processing	A5, B1

The numbering is in a logical sequence for diagnostics.
Always start diagnosing within a functional block in the sequence of the relevant test points for that block.
Perform measurements under the following conditions:

- Service Default Mode (when this mode is not present, set all controls to 50% and volume select channel 3).
- Service Default Mode.
- Video: color bar signal.
- Audio: 3 kHz left, 1 kHz right.

Service Modes

Service Default Mode (SDM) and Service Alignment Mode (SAM) offer several features for the service technician, while the Customer Service Mode (CSM) is used for communication between dealer and customer.
Note: Some L8 and M8 chassis sets use a software version that does not contain the Service Modes (see table). In this case, use the special Factory Mode Remote Control. This can be ordered by service code 4835 310 57511. Complete instructions are included. This remote control will place the TV in the Factory Mode and allow access to all adjustments that a normal Service Mode contains (including setting Option Bytes). Error codes will not be available. There is also the option of using ComPair, a hardware interface between a computer (see requirements) and the TV chassis. It offers the ability of structured trouble shooting, error code reading and software version readout for all L8 and M8 chassis.
Requirements: To run ComPair on a computer (laptop or desktop) requires, as a minimum, a 486 processor, Windows 3.1 and a CD-ROM drive. A Pentium Processor and Windows 95/98 are also acceptable (see also ***ComPair***

SW. cluster	Software name	UOC-type	Diversity	Remark
1US0	L01UN0-x.y	TDA9587	Stereo, non-DBX, CC	All Service Modes
1US1	L01US1-x.y	TDA9587/ TDA9588	Stereo, DBX, CC	Only Com-Pair (*)
2US0	L01UM0-x.y	TDA9587	Mono, CC	All Service Modes
2US1	L01UM1-x.y	TDA9587	Mono, CC	Without CSM (*)
3US0	L01US0-x.y	TDA9588	Stereo, DBX, CC	Only Com-Pair (*)
3US1	L01UN1-x.y	TDA9587	Stereo, non-DBX, CC	Without CSM (*)
Abbreviations in 'Software name': U= USA, N= stereo non-DBX, S= stereo DBX, M= mono				

Service Default Mode (SDM)

Purpose

- To create a predefined setting to get the same measurement results as given in this manual.
- To override SW protections.
- To start the blinking LED procedure.

Specifications

- Tuning frequency: 61.25 MHz (channel 3).
- Color system: NTSC.
- All picture settings at 50 % (brightness, color contrast, hue).
- Bass, treble and balance at 50 %; volume at 25 %.
- All service-unfriendly modes (if present) are disabled, like:
  - (sleep) timer,
  - child/parental lock,
  - blue mute,
  - hotel/hospitality mode
  - auto switch-off (when no 'IDENT' video signal is received for 15 minutes),
  - skip / blank of non-favorite presets / channels,
  - auto store of personal presets,
  - auto user menu time-out.

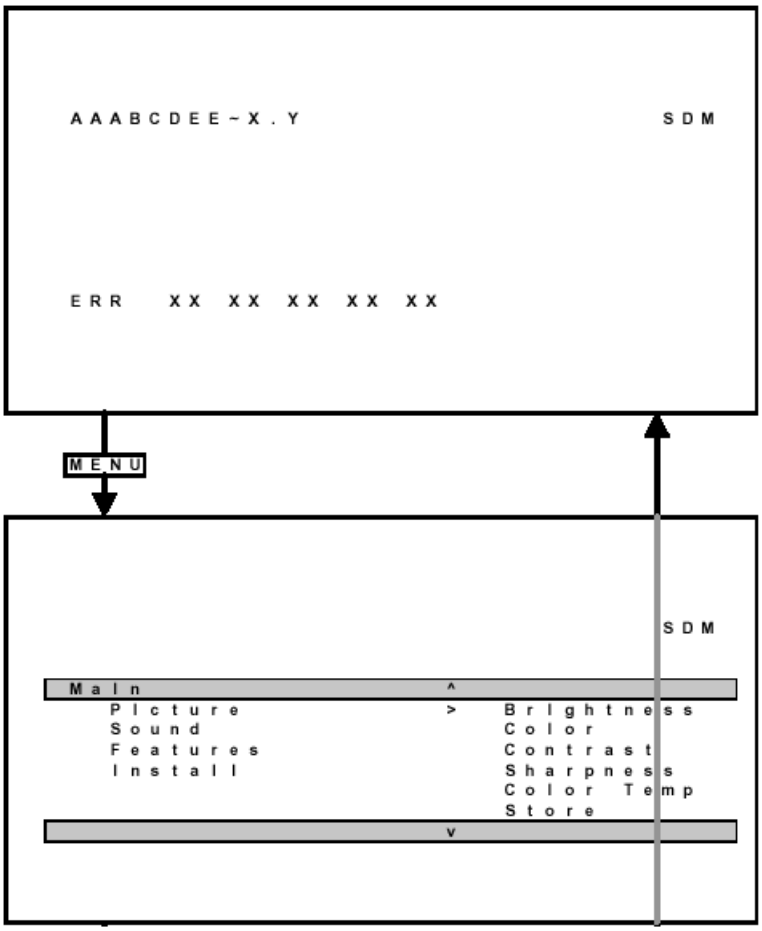
How to enter SDM

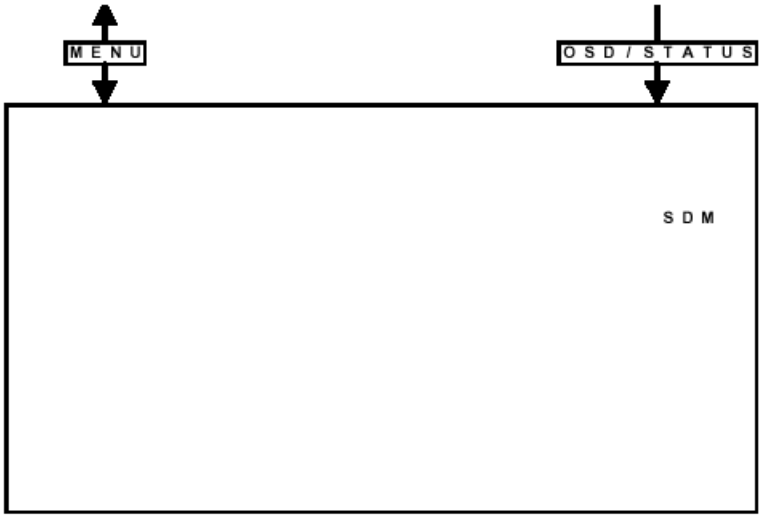
- Use a standard customer RC-transmitter and key in the code 062596 directly followed by the MENU button, or
- Short wires 9631 and 9641 on the mono carrier and switch the set ON apply AC power. Then press the power button (remove short after start-up).

Caution: Entering SDM by shorten wires 9631 and 9641 will override the +8V-protection. Do this only for a short period. When doing this, the service-technician must know exactly what he is doing, as it could lead to damaging the set.

- Or via ComPair

After entering SDM, the following screen is visible, with SDM at the upper right side for recognition.





How to navigate

- When you press the MENU button on the remote control, the set will switch between the SDM and the normal user menu (with the SDM mode still active in the background). Return to the SDM screen with the OSD / STATUS button.
- When you press the OSD / STATUS button on the remote control, the menu will show or hide the error buffer. This feature is available to prevent interference during waveform measurements.
- On the TV press and hold the 'VOLUME down' and press the 'CHANNEL down' for a few from SDM to SAM and reverse.

How to exit

Switch the set to STANDBY by pressing the power button on the remote control transmitter (if you switch the set OFF by removing the AC power, the set will return in SDM when AC power is re-applied). The error buffer is cleared.

Service Alignment Mode (SAM)

Purpose

- To perform alignments.
- To change option settings.
- To display / clear the error code buffer.

Specifications

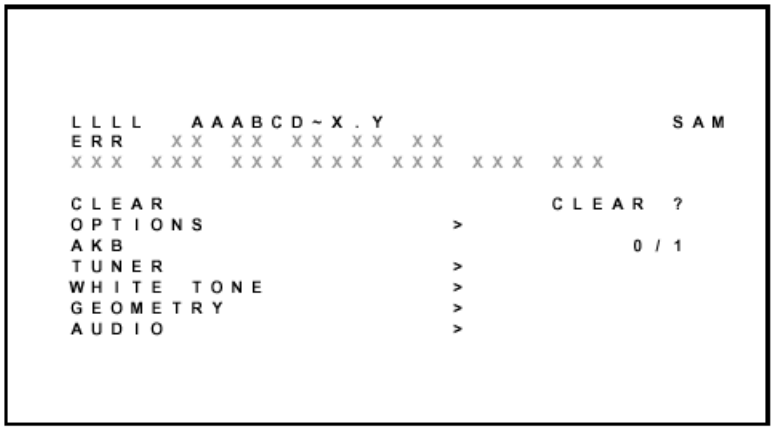
- Operation hours counter.
- Software version.
- Option settings.
- Error buffer reading and erasing.
- Software alignments.

How to enter

- Use a standard customer RC-transmitter and key in the code 062596 directly followed by the OSD / STATUS button or

- Via ComPair.

The following screen is visible, with SAM at the upper right side for recognition.



1. LLLL This is the operation hours counter. It counts the normal operation hours, not the standby hours.
2. AAABCD-X.Y This is the software identification of the main micro controller
   - A = the project name (L01).
   - B = the region: E = Europe, A = Asia Pacific, U = NAFTA, L = LATAM.
   - C = the software diversity: N = stereo non-DBX, S = stereo DBX, M = mono, D = DVD.
   - D = the language cluster number.
   - E = UOC diversity.
   - X = the main software version number.
   - Y = the sub software version number.
3. SAM Indication of the actual mode.
4. Errors buffer Five errors possible.
5. Option bytes Seven codes possible.
6. Clear Erase the contents of the error buffer. Select the CLEAR menu item and press the CURSOR RIGHT key. The content of the error buffer is cleared.
7. Options To set the Option Bytes. See chapter 8.3.1 for a detailed description.
8. AKB Disable (0) or enable (1) the 'black current loop' (AKB = Auto Kine Bias).
9. Tuner To align the Tuner. See chapter 8.3.2 for a detailed description.
10. White Tone To align the White Tone. See ***White tone*** for a detailed description.
11. Geometry To align the set geometry. See ***Geometry*** for a detailed description.
12. Audio No audio alignment is used for NTSC.

How to navigate

- In SAM, select menu items with the CURSOR UP/DOWN key on the remote control transmitter. The selected item will be highlighted. When not all menu items fit on the screen, move the CURSOR UP/DOWN key to display the next / previous menu items.
- With the CURSOR LEFT/RIGHT keys, it is possible to:
  - (De)activate the selected menu item.
  - Change the value of the selected menu item.
  - Activate the selected submenu.
- When you press the MENU button twice, the set will switch to the normal user menus (with the SAM mode still active in the background). To return to the SAM menu press the OSD / STATUS button [i+].

- When you press the MENU key in a submenu, you will return to the previous menu.

How to exit

Switch the set to STANDBY by pressing the power button on the remote control transmitter (if you switch the set OFF by removing the AC power, the set will return in SAM when AC power is re-applied). The error buffer is not cleared.

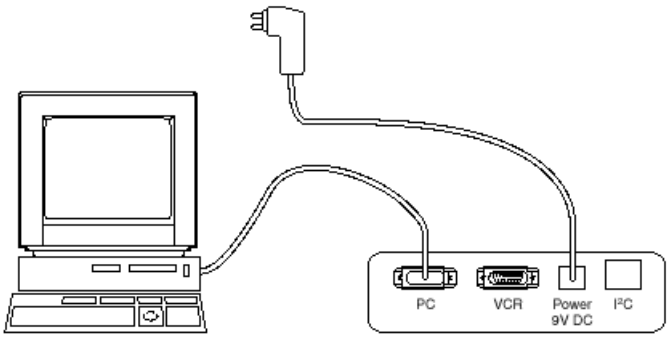
Customer Service Mode (CSM)

Purpose

The Customer Service Mode is (de-)activated by the customer upon request of the service technician during a telephone conversation, in order to identify the status of the set. This CSM is a read only mode, therefore modifications in this mode are not possible.

How to enter

The CSM will be turned on after pressing the MUTE key on the remote control transmitter and any of the control buttons on the TV for at least 4 seconds simultaneously. This activation only works if there is no menu on the screen. After switching ON the Customer Service Mode, the following screen will appear:



1. Software identification of the main micro controller (see ***Service Alignment Mode (SAM)*** for an explanation).
2. Error code buffer (see ***Error Codes*** for more details). Displays the last seven errors of the error code buffer.
3. In this line, the Option Bytes (OB) are visible. Each Option Byte is displayed as a decimal number between 0 and 255. The set may not work correctly when an incorrect option code is set. See ***Options*** for more information on the option settings.
4. Indicates which color and sound system is installed for the selected pre-set.
5. Indicates if the set is not receiving an 'IDENT' signal on the selected source. It will display 'Not Tuned'.
6. Indicates if the sleep timer is enabled.
7. Indicates if the V-chip feature is enabled.
8. Value indicates parameter levels at CSM entry.
   CO = CONTRAST, CL = COLOR, BR = BRIGHTNESS,
   HU = HUE, SH = SHARPNESS
9. Value indicates parameter levels at CSM entry.
   VL = VOLUME LEVEL, BL = BALANCE LEVEL, AVL LIM
   = AUTO VOLUME LEVEL LIMITER
10. Value indicates parameter levels at CSM entry.
    DV = DELTA VOLUME, BS = BASS LEVEL, TR = TREBLE LEVEL

How to exit

You can turn the Customer Service Mode off:

- After you press 'any' key of the remote control transmitter with exception of the CHANNEL and VOLUME keys.
- After you switch-off the TV set with the AC power switch.

Problems And Solving Tips (Related To CSM)

Picture Problems

No colors / noise in picture

Check CSM line 4. Wrong color system installed. To change the setting:

1. Select the MANUAL STORE sub menu.
2. Select and change the SYSTEM setting until picture and sound are correct.
3. Select the STORE menu item.

Colors not correct / unstable picture

Check CSM line 4. Wrong color system installed. To change the setting:

1. Press the MENU button on the remote control.
2. Select the INSTALL sub menu.
3. Select the MANUAL STORE sub menu.
4. Select and change the SYSTEM setting until picture and sound are correct.
5. Select the STORE menu item.

TV switches off or changes channel without any user action

The TV set switches off after TV SWITCHING OFF was displayed.
Auto standby switched the set off because:

- There was no 'ident' signal for more than 15 minutes or
- There was no remote control signal received or local key pressed for > 2 hours.

See ***Alignments*** for a description of the options to enable / disable auto standby

Picture too dark or too bright

Increase / decrease the BRIGHTNESS and / or the CONTRAST value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

White line around picture elements and text

Decrease the SHARPNESS value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

Snowy picture

Check CSM line 5. If this line indicates 'Not Tuned', check the following:

- No or bad antenna signal. Connect a proper antenna signal.
- Antenna not connected. Connect the antenna.
- No channel / preset is stored at this program number. Go to the INSTALL menu and store a proper channel at

this program number.
- The tuner is faulty (in this case the CODES line will contain error number 10). Check the tuner and replace / repair if necessary.

Snowy picture and/or unstable picture

- A scrambled or decoded signal is received.

Black and white picture

Increase the COLOR value when:
- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

Menu text not sharp enough

Decrease the CONTRAST value when:
- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

Sound Problems

No sound or sound too loud (after channel change / switching on)
Increase / decrease the VOLUME level when the volume is OK after you switched on the CSM. The new 'Personal' preference value is automatically stored.

ComPair

Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the European DST (service remote control), which allows faster and more accurate diagnostics. Compare has three big advantages:
- ComPair helps you to quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.
- ComPair allows very detailed diagnostics (on I^2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I^2C commands yourself because ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan electronic manual of the defective chassis, schematics and PWBs are only a mouse click away.

Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable.
In case of the L8/M8 chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector (located on the Main panel, see ***Hardware alignments*** suffix D).

The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in two ways:

1. **Automatic (by communication with the television)**
   ComPair can automatically read out the contents of the entire error buffer. Diagnosis is done on I^2C level. ComPair can access the I^2C bus of the television. ComPair can send and receive I^2C commands to the micro controller of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the I^2C busses of the TV-set.
2. **Manually (by asking questions to you)**
   Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extend. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. Does the screen gives a picture? Click on the correct answer: YES / NO) and showing you examples (e.g. Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope). You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

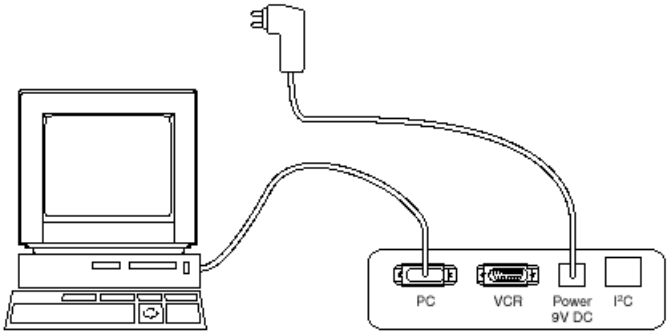
By a combination of automatic diagnostics and an interactive question / answer procedure, ComPair will enable you to find most problems in a fast and effective way.
Beside fault finding, ComPair provides some **additional features** like:

- Up- or downloading of presets.
- Managing of preset lists.
- Emulation of the (European) Dealer Service Tool (DST).
- If both ComPair and SearchMan (Electronic Service Manual) are installed, all the schematics and the PWBs of the set are available by clicking on the appropriate hyperlink.

Example: *Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier.*
Click on the 'Panel' hyperlink to automatically show the PWB with a highlighted capacitor C2568.
Click on the 'Schematic' hyperlink to automatically show the position of the highlighted capacitor.

How To Connect

1. First install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with 'PC') of the ComPair interface.
3. Connect the AC power adapter to the supply connector (marked with 'POWER 9V DC') on the compare interface.
4. Switch the ComPair interface OFF.
5. Switch the television set OFF, remove the AC power.
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with 'I^2C') and the ComPair connector on the mono carrier (see ***Hardware alignments*** suffix D).
7. Plug the AC power adapter in the AC power outlet and switch on the interface. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
8. Start the ComPair program and read the introduction chapter.



How To Order

ComPair order codes:

- Starter kit ComPair + SearchMan software + compare interface (excluding transformer): 4822 727 21629
- ComPair interface (excluding transformer): 4822 727 21631
- Starter kit ComPair software (registration version): 4822 727 21634
- Starter kit SearchMan software: 4822 727 21635
- ComPair CD (update): 4822 727 21637
- SearchMan CD (update): 4822 727 21638
- ComPair interface cable: 3122 785 90004

Error Codes

Introduction

The error code buffer contains all errors detected since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, it is written at the left side and all other errors shift one position to the right.
The error code buffer is cleared in the following cases:

- By activation of the CLEAR command in the SAM menu:
- When you exit SDM / SAM with the STANDBY command on the remote control (when leaving SDM / SAM, by disconnecting the set from AC power, the error buffer is not reset).
- When you transmit the command DIAGNOSE-99-OK with ComPair.
- If the content of the error buffer has not changed for 50 hours, it resets automatically.

Examples:
ERROR: 0 0 0 0 0: No errors detected.
ERROR: 6 0 0 0 0: Error code 6 is the most recent and only detected error.
ERROR: 9 6 0 0 0: Error code 6 was first detected and error code 9 is the most recent detected error.
You can also make the contents of the error buffer visible via the blinking LED procedure (see ***The Blinking LED Procedure).*** This is especially useful when there is no picture.

Error Codes

In case of non-intermittent faults, clear the error buffer before you begin the repair. These to ensure that old error codes are no longer present.
If possible, check the entire contents of the error buffer. In some situations an error code is only the result of another error code and not the actual cause (e.g., a fault in the protection detection circuitry can also lead to a protection).

Err.	Device	Error description	Symptom	Check	Diagram
0	-	No Error	-	-	-
1	-	X-Ray / overvoltage protection	Set will hiccup until it goes to protection mode	2407 & 7402 (L8), 2465 & 7460 (M8)	A2
2	-	High beam current		CRT panel, 3340	B1, B2
	-	Horizontal protection	- Set will hiccup until it goes to protection mode - Fly back line after 5 s in protection mode	+200V, LOT 5445, 7460 - 7463, 6467, hor. defl. coil	A2
3	TDA8359 / TDA9302	Vertical protection	- Set will hiccup until it goes to protection mode - One hor. Line after 5 s in protection mode	VIotAux+13V, +50V (M8), 7471, vert. defl. Coil	A2, A3
4	MSP34X5 / TDA9853	MSP I²C identification error	Set turned on without sound output	Vlotaux+5V, +8V, 7831, 3823/33, 7861, 3865/66	A9 or A11
5	TDA95xx	POR / +8V protection	Set will hiccup and goes to protection mode after 8 s	3V3, +8V, 7200, 7560, 7480	A5 - A7, A1, A2
6	I© bus	General I²C bus error	Set is in protection mode	SDA/SCL, 1000, 7200, 7600/01, 3624/25	A7
7	AN7522/3	Power down (over current) protection	Set will hiccup until it goes to protection mode	MainAux, 7901/02, 7561/62	A8, A1
8	-	E/W protection (Large Screen)	Geometry wrong or set in protection mode	Vlotaux+11V, 3400, 3405/06, 7400	A2
9	M24C08	NVM I²C identification error	Set will turn on but is unable to store data	3V3, 7601/02, 3611, 3603/04	A7
10	Tuner	Tuner I²C identification error	Set will turn on but has no picture and sound	Vlotaux+5V, 1000, 7482	A4, A2
11	TDA6107/8	Black current loop protection	Fly back line after 5 s in protection mode	+200V, 7330, RGB amps, CRT	B1, B2
12	M65669	PIP I²C identification error	Picture in picture does not function	+5V, +8V, 7803, 7890/91	P

The Blinking LED Procedure

Via this procedure you can make the contents of the error buffer visible via the front LED. This is especially useful when there is no picture.

When the SDM is entered, the LED will blink the contents of the error-buffer.

Error-codes ≥ 10 are shown as follows:
- a long blink of 750 ms (which is an indication of the decimal digit),
- a pause of 1.5 s,
- n short blinks (n = 1 - 9),
- when all the error-codes are displayed, the sequence finishes with a LED blink of 3 s,
- the sequence starts again.

Example of error buffer: 12 9 6 0 0
After entering SDM:
- 1 long blink of 750 ms followed by a pause of 1.5 s,
- 2 short blinks followed by a pause of 3 s,
- 9 short blinks followed by a pause of 3 s,
- 6 short blinks followed by a pause of 3 s,
- 1 long blink of 3 s to finish the sequence,
- the sequence starts again.

Protections

If a fault situation is detected an error code will be generated and if necessary the set will be put in the protection mode.

Blinking of the red LED at a frequency of 3 Hz indicates the protection mode. In some error cases the microprocessor does not put the set in the protection mode. The error codes of the error buffer can be read via the service menu (SAM), the blinking LED procedure or via ComPair. The DST diagnose functionality will force the set into the Service-standby, which is similar to the usual standby mode, however the microprocessor has to remain in normal operation completely.
To get a quick diagnosis the chassis has three service modes implemented:

- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). Adjustment of the set via a menu and with the help of test patterns.

See for a detailed description ***Circuit description***

Repair Tips

Below some failure symptoms are given, followed by a repair tip.

- **Set is dead and makes hiccuping sound**
  'MainSupply' is available. Hiccupping stops when de-soldering L5561, meaning that problem is in the 'MainSupply' line. No output voltages at LOT, no horizontal deflection. Reason: line transistor 7460 is defective.
- **Set is dead, and makes no sound**
  Check power supply IC 7520. Result: voltage at pins 1, 3, 4, 5 and 6 are about 180 V and pin 8 is 0 V. The reason why the voltage on these pins is so high is because the output driver (pin 6) has an open load. That is why MOSFET 7521 is not able to switch. Reason: feedback resistor 3523 is defective. Caution: be careful measuring on the gate of 7521; circuitry is very high ohmic and can easily be damaged!
- **Set is in hiccup mode and shuts down after 8 s.**
  Blinking LED (set in SDM mode) indicates error 5. As it is unlikely that ?P 'POR' and '+8V protection' happen at the same time, measure the '+8V'. If this voltage is missing, check transistor 7480.
- **Set is non-stop in hiccup mode**
  Set is in over current mode; check the secondary sensing (opto coupler 7515) and the 'MainSupply' voltage. Signal 'Stdby_con' must be logic low under normal operation conditions and goes to high (3.3 V) under standby and fault conditions.
- **Set turns on, but without picture and sound**
  The screen shows snow, but OSD and other menus are okay. Blinking LED procedure indicates error 11, so problem is expected in the tuner (pos. 1000). Check presence of supply voltages. As 'Vlotaux+5V' at pin 5 and 7 are okay, 'VT_supply' at pin 9 is missing.
  Conclusion: resistor 3460 is defective.
- **Set turns on, but with a half screen at the bottom.**
  Sound is okay
  Blinking LED (set in SDM mode) indicates error 3. Check 'Vlotaux+11V' and '+50V'. If they are okay, problem is expected in the vertical amplifier IC 7471. Measure with a scope the waveform on pin 17 of the UOC. Measure also at pin 1 of IC 7471. If here the signal is missing, a defective resistor R3244 causes the problem.

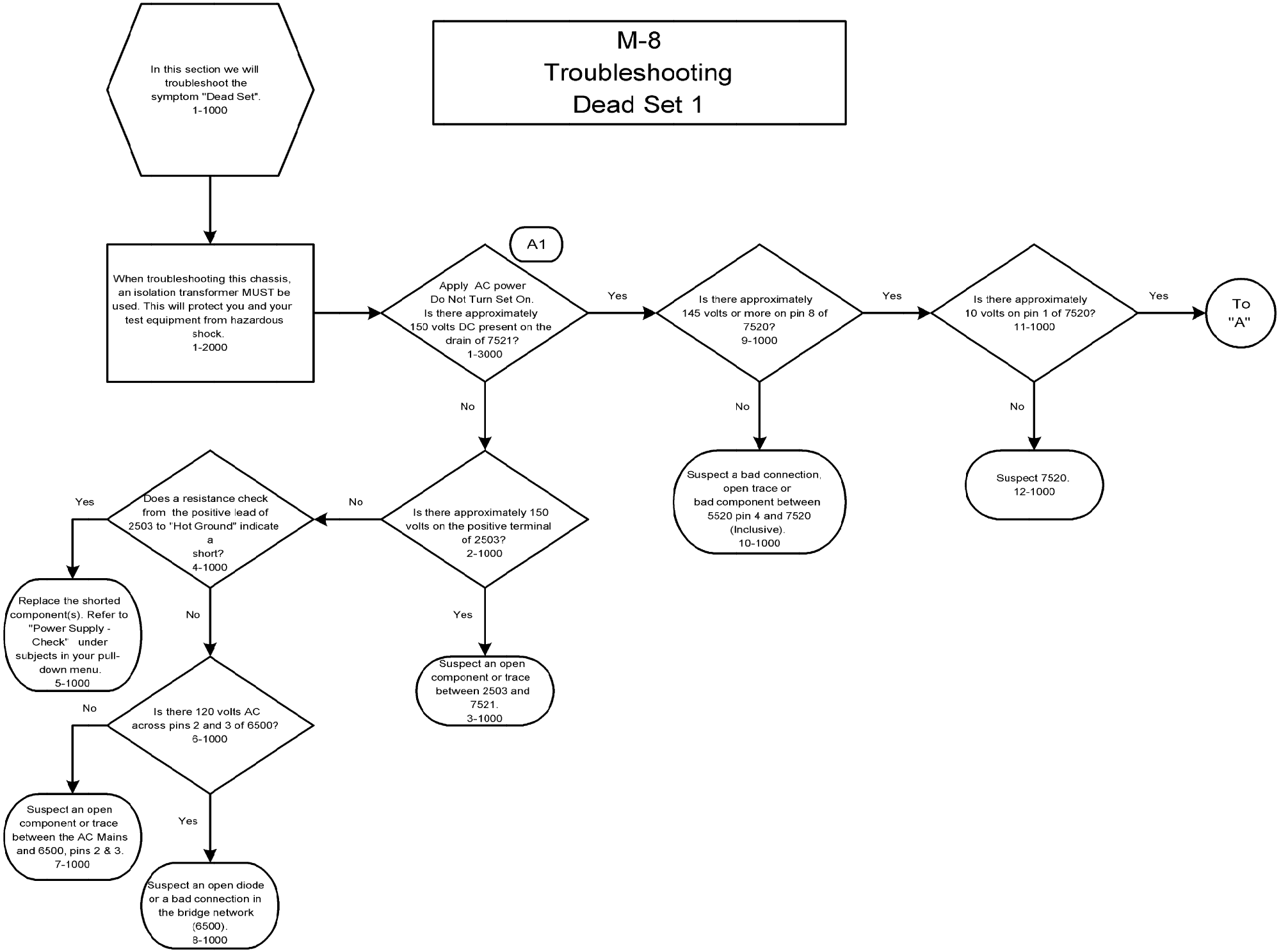
TROUBLESHOOTING FLOW CHARTS

DEAD SET PAGE 1

DEAD SET PAGE 2

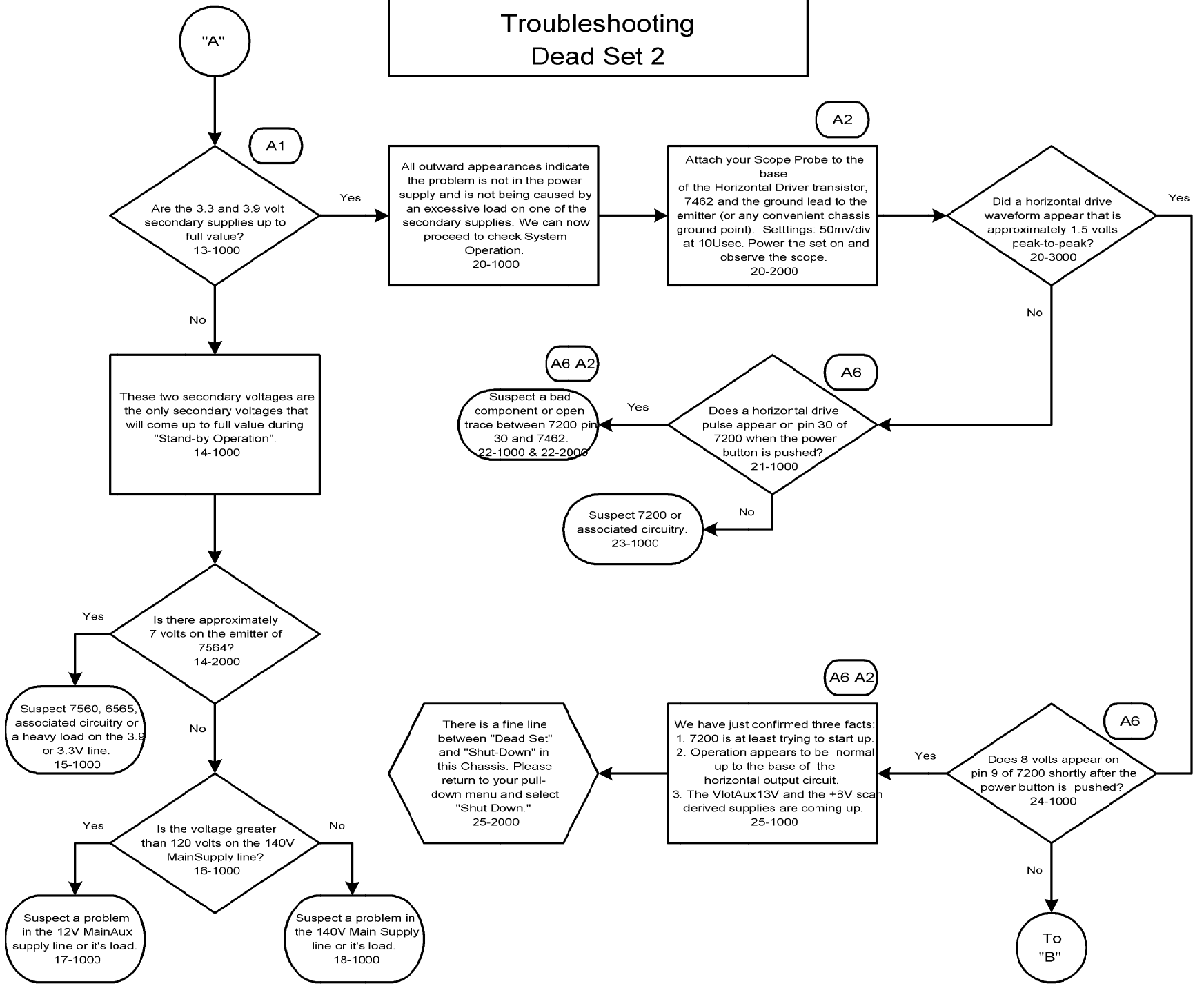
DEAD SET PAGE 3

M-8
Troubleshooting
Dead Set 1



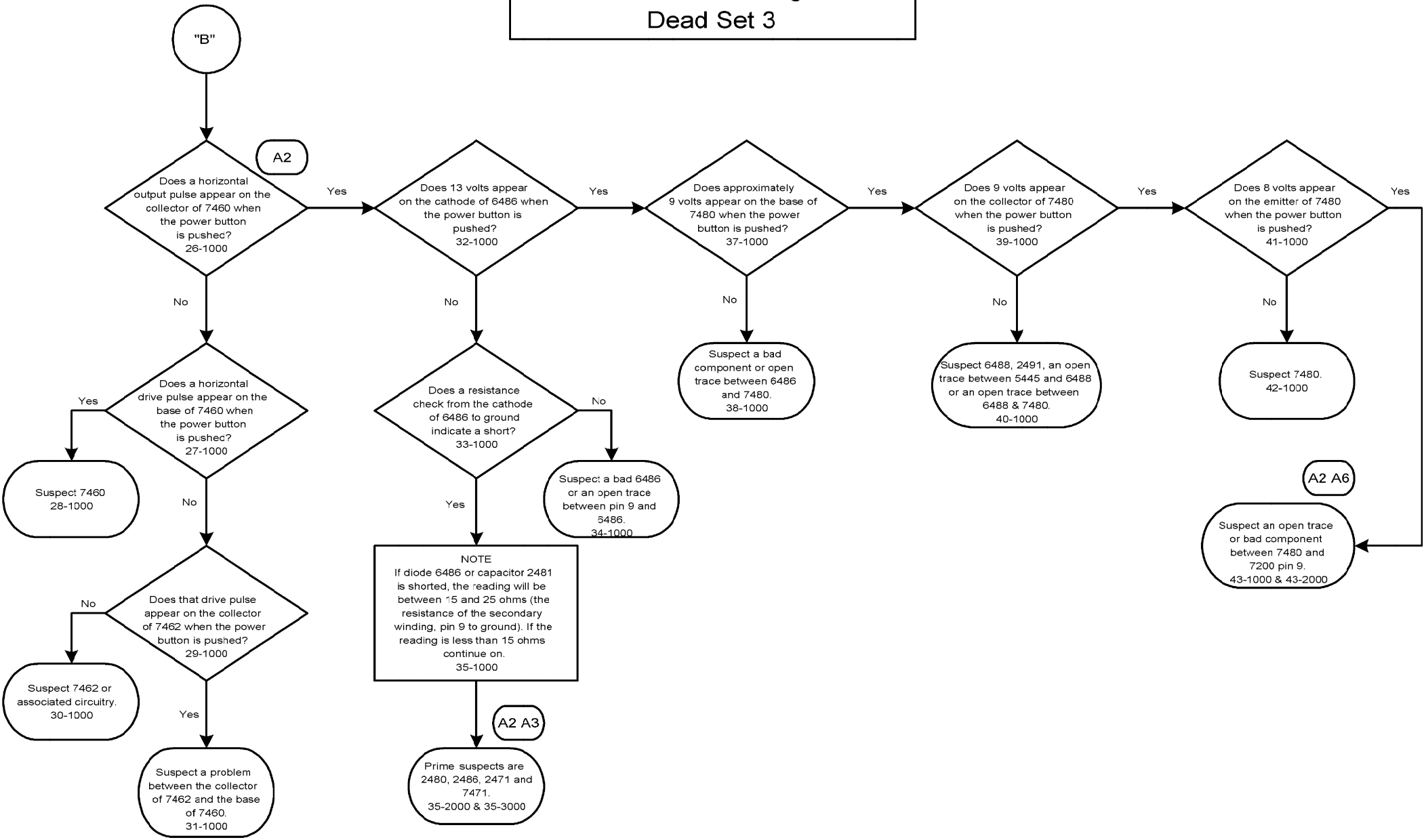
Note: (XX) Indicates the Schematic Page being talked about.

M-8 Troubleshooting Dead Set 2



Note: (xx) Indicates the Schematic Page being talked about.

M-8
Troubleshooting
Dead Set 3



Note: (XX) Indicates the Schematic Page being talked about.

M-8 Troubleshooting Shut-Down

The symptom we will be troubleshooting in this section is "Shut-down". If you are in doubt about what your symptom is, refer to "Dead Set" in your pull-down menu.
1-1000

A2

Is the horizontal pulse clean at the collector of the horizontal output transistor when the power button is pushed?
1-2000

No → Suspect 7460 or a component in the collector circuit.
2-1000

Yes

Does the collector of 7441 measure lower than 5 volts when the power button is pushed?
3-1000

Yes → A2 A5 → Suspect an under-voltage problem. Most likely between pin 7 of 5445 and 7441 OR..... (continue)
16-1000

No

A6

Is the voltage on 7200 pin 34 less than 1.8 volts or greater than 3.2 volts?
4-1000

Yes

Is the voltage less than or more than the parameters listed?
17-1000

More → Suspect an over-voltage condition. Check 5445, the Filament line or 7443.
19-1000

Less → Suspect an over-current condition. The EHTinfo line is causing shutdown.
18-1000

No

A6 A2

We have just checked the EHTinfo and EHTo secondary lines and they are OK. We have also confirmed correct operation of the Power_ Down line because both the +8V and the EHTo lines are working.
5-1000 & 5-2000

A2

Is there a horizontal pulse at the junction of 6449 and 3469 when the power button is pushed?
5-3000

No → A2 A6 → Suspect a bad component or open trace between 5445, pin 6 and 6449.
20-1000

Yes

A6

Is there a horizontal pulse at pin 31 of 7200 when the power button is pushed?
21-1000

No → Suspect a bad component or open trace between 6449 and pin 31 of 7200.
7-1000 & 7-2000

Yes

A2

Is there 50 volts on the positive lead of 2487 when the power button is pushed?
6-1000

No → A3 → Suspect a bad component or open trace between 5445 pin 11 and 2487, a shorted 7471 or a bad component associated with pin 6 of 7471.
8-1000 & 8-2000

Yes

A5

Does 2.5 volts appear on 7200 pin 54 when the power button is pushed?
9-1000

No → Suspect 7204 or associated circuitry.
10-1000

Yes

A5

Do vertical blanking pulses appear on pin 5 of 0243 when the power button is pushed?
11-1000

No → A3 A2 A5 → Suspect a bad 7471 or an open trace or bad component between 7471 pin 7 and pin 5 of 0243.
12-1000, 12-2000

Yes

Is the voltage on 7200 pin 55 approximately 5.5V when the power button is pushed?
13-1000

No → A5 B1 → Suspect 7200, an open trace, bad component or a shorted 7330 on the CRT board.
14-1000, 14-2000

Yes → A5 → Suspect 7200.
15-1000

Note: (XX) Indicates the Schematic Page being talked about.

M-8
Troubleshooting
Power Supply Check 1

In this section, we will discover a method of checking the power supply after parts have been replaced and prior to applying AC power.
1-1000

A1

If, while troubleshooting a "Dead Set" symptom, we find fuse 1500 open and FET 7521 shorted, they will obviously have to be replaced. It is good practice to replace resistor 3527 and IC 7520 at this time.
1-2000

Resistor 3527 is a current sensing device and when 7521 shorted, 3527 was subjected to an excessive amount of current flow. This resistor is 1 ohm in resistance at 1% tolerance. It would not take much of a current increase to change the value adversly. This change would not be detected by an ohmeter.
1-3000

If we examine 7521's circuitry, we can see that when it shorted, the entire value of our raw B+ was placed on pins 5 and 6 of 7520. It would be good practice to replace this IC at this time because of the level of stress it has been subjected to.
1-4000

Now that we have replaced the necessary parts, we must try to figure out any possible causes for the failure that may not be related to the parts we changed.
1-5000

The frequency of operation of 7520 and the conduction (on time) of 7521 is determined by feedback variations from IC 7515 and the feedback circuitry.
1-6000

If we were to apply AC power and the cause of the problem was in our feedback path, we would end up having to replace those same parts again.
1-7000

Our first test in the feedback path will be to determine if 7541, 7542 and 7515 are operating properly.
1-8000

Put the positive lead of your ohmeter on pin 3 and the negative lead on pin 4 of IC 7515.
1-9000

Place a jumper wire from the cathode of 6569 to the cathode 6562. Apply the positive lead of a variable DC power supply to either end of the jumper wire and the negative lead to chassis (cold) ground. Set the power supply to zero and turn it on. Slowly raise the voltage from zero to seven (7) volts (+ or -) 2 volts.
1-10000

Did the resistance reading on the ohmeter go down?
1-11000

Yes

No

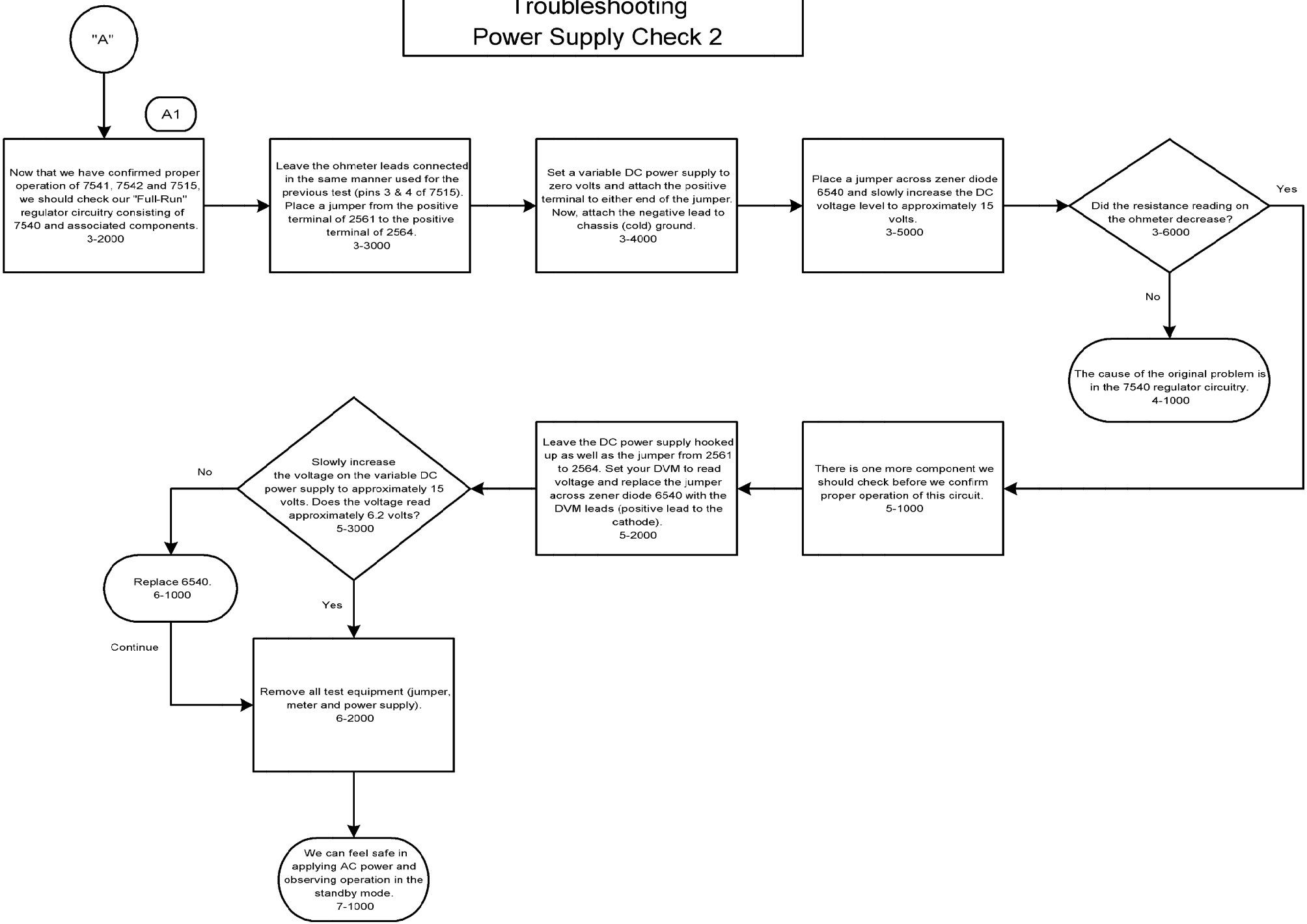
The source of our problem is in the circuitry or associated components under test.
2-1000

The circuitry under test can be considered operational.
3-1000

To "A"

Note: (xx) Indicates the Schematic Page being talked about.

M-8
Troubleshooting
Power Supply Check 2



Note: (XX) Indicates the Schematic Page being talked about.

M-8
Troubleshooting
No Audio 1

The symptom we will be troubleshooting in this section is "No Audio."
1-1000

For purposes of this exercise, we will consider the Video To be working properly.
1-2000

Is the chassis you are working on Stereo?
1-3000

Yes

Make sure your set is tuned to a strong Stereo station prior to making the next series of checks.
11-1000

A5

Is there an indication of the presence of baseband audio on pin 33 of 7200?
11-2000

Yes

A9

Is there an indication of the presence of baseband audio on pin 47 of 7831?
13-1000

Yes

To "A"

More Info

No

Suspect 7200.
12-1000

No

A5 A9

Suspect an open trace or bad component between 7200 and 7831.
15-1000 & 15-2000

No

A5

Does Audio appear on pin 48 of 7200?
2-1000

Yes

No

Suspect 7200 or associated circuitry.
3-1000

A8

Does Audio appear on pin 6 of 7902?
4-1000

No

A6 A8

Suspect a bad component or open trace between pin 48 of 7200 and pin 6 of 7902.
5-1000 & 5-2000

Yes

Does Audio appear on pins 2 and 4 of 7902?
6-1000

Yes

Suspect an open trace, open wire, bad connection between pin 2 or 4 and the speaker or the speaker itself.
7-1000

No

Use the Audio Supply ground.
Is the voltage on pin 1 of 7902 approximately 11.5 volts?
8-1000

Yes

Suspect 7902.

10-1000

No

Suspect an open trace or bad component between 3564 and pin 1 and/or a shorted pin 1 Internally.
9-1000 & 9-2000

If, while making the last two checks, you have been unable to determine what you were seeing on your scope, the next check will help you narrow down the problem area. Hook an external Stereo audio source (Generator/VCR, etc.) to the AV1 left and right inputs on the Rear Jack Panel and select AV1 as your source.
29-1000

After increasing the volume, can you hear audio?
29-2000

No

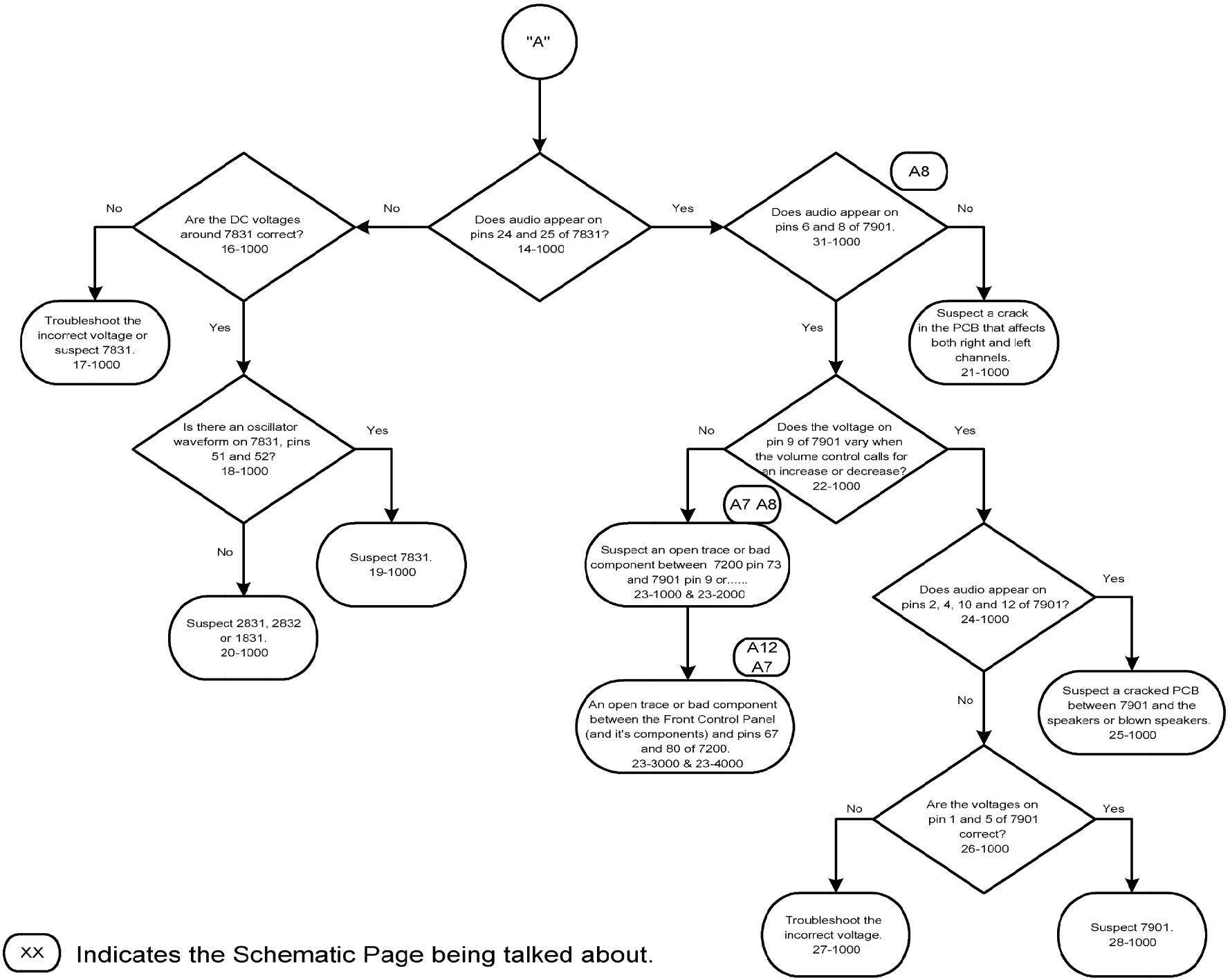
To "A"

Yes

Excluding a problem in the Demodulator Section of 7831, the problem should be 7200 or associated circuitry.
30-1000 & 30-2000

Note: (xx) Indicates the Schematic Page being talked about.

M-8
Troubleshooting
No Audio 2



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General Information

REFER TO SAFETY GUIDELINES

SAFETY NOTICE: ANY PERSON ATTEMPTING TO SERVICE THIS CHASSIS MUST FAMILIARIZE HIMSELF WITH THE CHASSIS AND BE AWARE OF THE NECESSARY SAFETY PRECAUTIONS TO BE USED WHEN SERVICING ELECTRONIC EQUIPMENT CONTAINING HIGH VOLTAGES.

CAUTION: USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING

 Visit our World Wide Web Site at http://www.forceonline.com

Technical Specifications, Connections And Chassis Overview

Technical Specifications

Audio ratings

1 W mono
2 x 1 W non-DBX stereo (LC stereo)
2 x 3 W DBX stereo (with SAP)

Reception

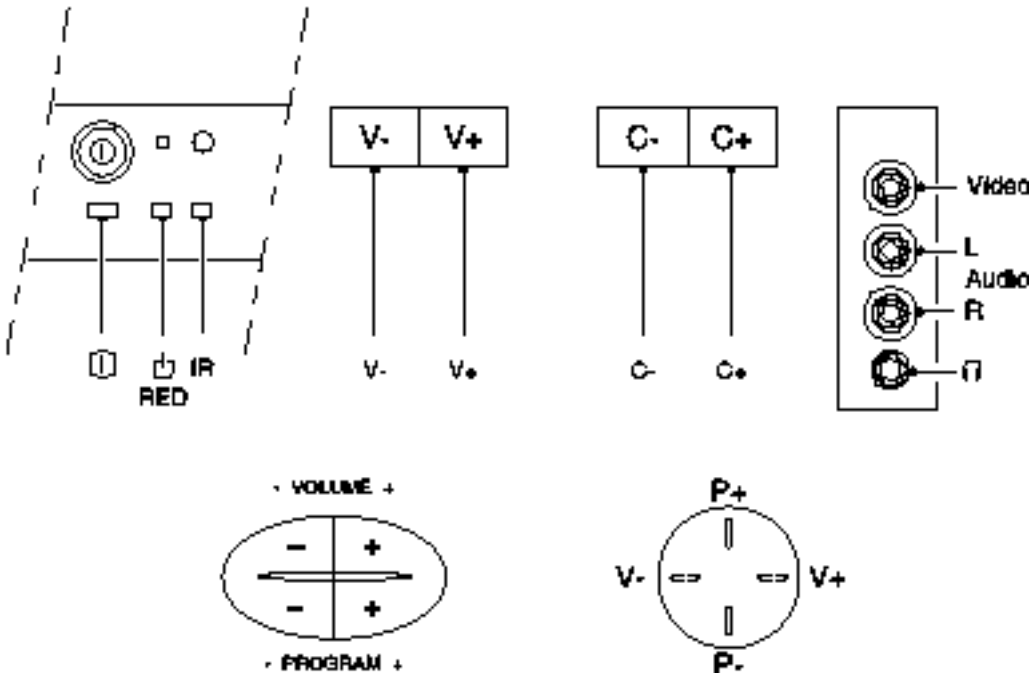
Tuning system	: PLL
Color systems	: NTSC
Sound systems	: FM-mono
	: BTSC non-DBX
	BTSC DBX
A/V connections	: NTSC M
Channel selections	: 181 channels, full cable
IF frequency	: 45.75 MHz
Aerial input	: 75 Ω, Coax

Miscellaneous

AC voltage	: 90 - 140 V (±10 %)
AC frequency	: 60 Hz (±5 %)
Ambient temperature	: + 5 to + 45 deg. C
Maximum humidity	: 90 %
Power consumption	: 36 W (14")
	100 W (32")
Standby Power consumption	: < 3 W

Connections

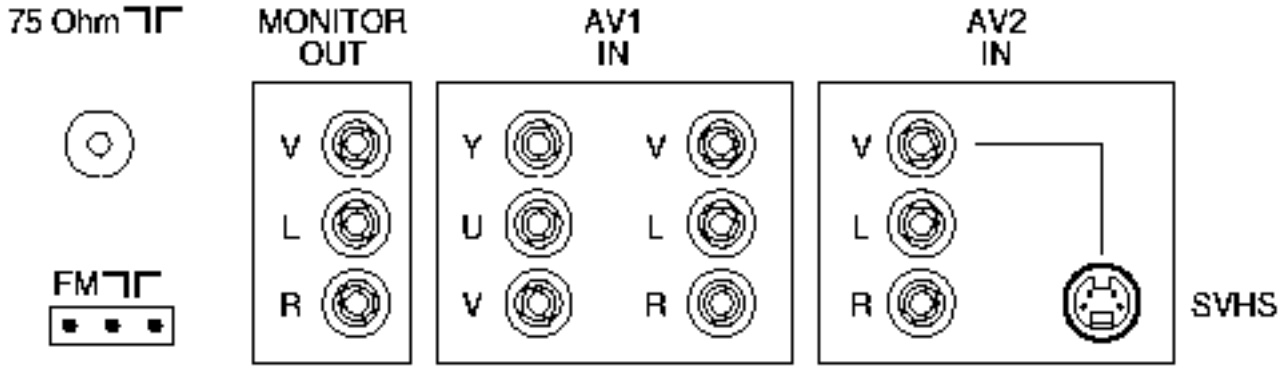
Front Or Top Control, Front Or Side Connections



Audio / Video In

1 - Video 1 Vpp / 75 Ω
2 - Audio L (0.2 Vrms / 10 kΩ)
3 - Audio R (0.2 Vrms / 10 kΩ)
4 - Headphone (3.5 mm) 8 - 600 Ω/ 4 mW

Rear Connections



Monitor Out

1 - Video	1 Vpp / 75 Ω	
2 - Audio	L (0.5 Vrms / 1 kΩ)	
3 - Audio	R (0.5 Vrms / 1 kΩ)	

YUV In

1 - Y	0.7 Vpp / 75 Ω	
2 - U	0.7 Vpp / 75 Ω	

3 - V	0.7 Vpp / 75 Ω	

AV1 In

4 - Video	1 Vpp / 75 Ω	
5 - Audio	L (0.5 Vrms / 10 kΩ)	
6 - Audio	R (0.5 Vrms / 10 kΩ)	

AV2 In

1 - Video	1 Vpp / 75 Ω	
2 - Audio	L (0.5 Vrms / 10 kΩ)	
3 - Audio	R (0.5 Vrms / 10 kΩ)	

AV2 In (SVHS)

1 -	gnd	
2 -	gnd	
3 - Y	1 Vpp / 75 Ω	
4 - C	0.3 Vpp / 75 Ω	

Safety & Maintenance Instructions, Warnings, And Notes

Safety Instructions For Repairs

Safety regulations require that during a repair:

- Due to the 'hot' parts of this chassis, the set must be connected to the AC power via an isolation transformer.
- Safety components, indicated by the symbol ⚠ should be replaced by components identical to the original ones.
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. Pay particular attention to the following points:

- General repair instruction: as a strict precaution, we advise you to re-solder the solder connections through which the horizontal deflection current is flowing, in particular:
  - all pins of the line output transformer (LOT)
  - fly-back capacitor(s)
  - S-correction capacitor(s)
  - line output transistor
  - pins of the connector with wires to the deflection coil
  - other components through which the deflection current flows.

Note: This re-soldering is advised to prevent bad connections due to metal fatigue in solder connections and is therefore only necessary for television sets more than two years old.

- Route the wire trees and EHT cable correctly and secure them with the mounted cable clamps.
- Check the insulation of the AC power cord for external damage.
- Check the strain relief of the AC power cord for proper function, to prevent the cord from touching the CRT, hot

components, or heat sinks.

- Check the electrical DC resistance between the AC plug and the secondary side (only for sets that have an isolated power supply). Do this as follows:
  1. Unplug the AC power cord and connect a wire between the two pins of the AC plug.
  2. Turn on the main power switch (keep the AC power cord unplugged!).
  3. Measure the resistance value between the pins of the AC plug and the metal shielding of the tuner or the aerial connection of the set. The reading should be between 4.5 M??and 12 M?.
  4. Switch the TV OFF and remove the wire between the two pins of the AC plug.
- Check the cabinet for defects, to prevent the possibility of the customer touching any internal parts.

Maintenance Instructions

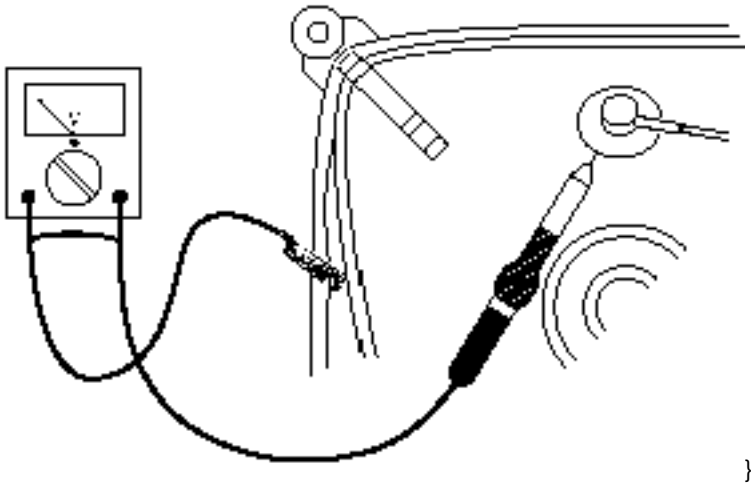
It is recommended to have a maintenance inspection carried out by qualified service personnel. The interval depends on the usage conditions:

- When the set is used under normal circumstances, for example in a living room, the recommended interval is three to five years.
- When the set is used in an environment with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is one year.
- The maintenance inspection includes the following actions:

1. Perform the 'general repair instruction' noted above.
2. Clean the power supply and deflection circuitry on the chassis.
3. Clean the picture tube panel and the neck of the picture tube.

Warnings

- In order to prevent damage to ICs and transistors, avoid all high voltage flashovers. In order to prevent damage to the picture tube, use the method shown in figure below, to discharge the picture tube. Use a high voltage probe and a multi-meter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).



}

- All ICs and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same

potential as the mass of the set by a wristband with resistance. Keep components and tools also at this potential. Available ESD protection equipment:
  - Complete kit ESD3 (small tablemat, wristband, connection box, extension cable, and ground cable) 4822 310 10671.
  - Wristband tester 4822 344 13999.
- Together with the deflection unit and any multi-pole unit, flat square picture tubes form an integrated unit. The deflection and the multi-pole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When you align the set, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

Notes

- Measure the voltages and waveforms with regard to the chassis (= tuner) ground ⊥, or hot ground (⊥ϟ), depending on the area of circuitry being tested.
- The voltages and waveforms shown in the diagrams are indicative. Measure them in the Service Default Mode with a color bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz (PAL) or 61.25 MHz (NTSC, channel 3).
- Where necessary, measure the waveforms and voltages with (⊓) and without (⊼) aerial signal. Measure the voltages in the power supply section both in normal operation (ⓘ) and in standby (⏻). These values are indicated by means of the appropriate symbols.
- The picture tube panel has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.

Abbreviation list

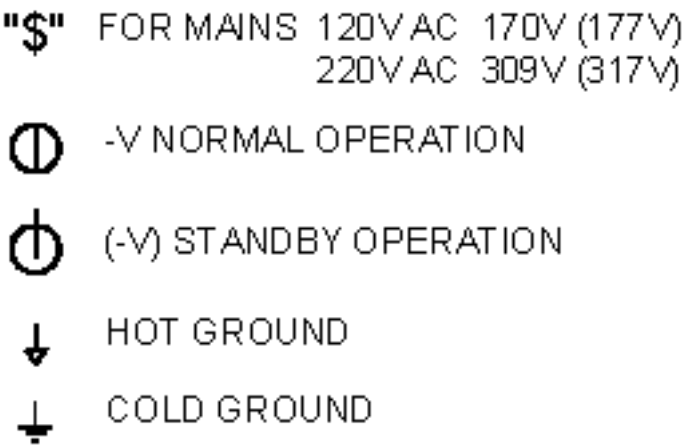
2CS	2 Carrier (or Channel) Stereo
ACI	Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page
ADC	Analogue to Digital Converter
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency
AFT	Automatic Fine Tuning
AGC	Automatic Gain Control: algorithm that controls the video input of the featurebox
AM	Amplitude Modulation
AP	Asia Pacific
AR	Aspect Ratio: 4 by 3 or 16 by 9
ATS	Automatic Tuning System
AV	External Audio Video
AVL	Automatic Volume Level
BC-PROT	Beam Current Protection
BCL	Beam Current Limitation
B/G	Monochrome TV system. Sound carrier distance is 5.5 MHz
BLC-	

INFORMATION	Black current informationrmation
BTSC	Broadcast Television Standard Committee. Multiplex FM stereo sound system, originating from the USA and used e.g. in LATAM and AP-NTSC countries
B-TXT	Blue teletext
CC	Closed Caption
ComPair	Computer aided rePair
CRT	Cathode Ray Tube or picture tube
CSM	Customer Service Mode
CTI	Colour Transient Improvement: manipulates steepness of chroma transients
CVBS	Composite Video Blanking and Synchronisation
DAC	Digital to Analogue Converter
DBE	Dynamic Bass Enhancement: extra low frequency amplification
DBX	Dynamic Bass Expander
D/K	Monochrome TV system. Sound carrier distance is 6.5 MHz
DFU	Direction For Use: description for the end user
DNR	Dynamic Noise Reduction
DSP	Digital Signal Processing
DST	Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode
DVD	Digital Versatile Disc
EEPROM	Electrically Erasable and Programmable Read Only Memory
EHT	Extra High Tension
EHT-INFORMATION	Extra High Tensioninformationrmation
EU	Europe
EW	East West, related to horizontal deflection of the set
EXT	External (source), entering the set via SCART or Cinch
FBL	Fast Blanking: DC signal accompanying RGB signals
FILAMENT	Filament of CRT
FLASH	Flash memory
FM	Field Memory
FM	Frequency Modulation
HA	Horizontal Acquisition: horizontal sync pulse coming out of the HIP
HFB	Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection
HP	Headphone
Hue	Colour phase control for NTSC (not the same as 'Tint')
I	Monochrome TV system. Sound carrier distance is 6.0 MHz
I2C	Integrated IC bus
IF	Intermediate Frequency
IIC	Integrated IC bus
Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in "pairs", causing line flicker.
ITV	Institutional TV
LATAM	Latin America
LED	Light Emitting Diode
L/L'	Monochrome TV system. Sound carrier distance is 6.5 MHz. L' is Band I, L is all bands except for Band I
LNA	Low Noise Amplifier
LS	Large Screen
LS	Loudspeaker

LSP	Large signal panel
M/N	Monochrome TV system. Sound carrier distance is 4.5 MHz
MSP	Multistandard Sound Processor: ITT sound decoder
MUTE	Mute-Line
NC	Not Connected
NICAM	Near Instantaneous Compounded Audio Multiplexing. This is a digital sound system, mainly used in Europe.
NTSC	National Television Standard Committee. Colour system mainly used in North America and Japan. Colour carrier NTSC M/N = 3.579545 MHz, NTSC 4.43 = 4.433619 MHz (this is a VCR norm, it is not transmitted off-air)
NVM	Non Volatile Memory: IC containing TV related data e.g. alignments
OB	Option Byte
OC	Open Circuit
OSD	On Screen Display
PAL	Phase Alternating Line. Colour system mainly used in West Europe (colour carrier = 4.433619 MHz) and South America (colour carrier PAL M = 3.575612 MHz and PAL N = 3.582056 MHz)
PCB	Printed Circuit board
PIP	Picture In Picture
PLL	Phase Locked Loop. Used for e.g. FST tuning systems. The customer can give directly the desired frequency
POR	Power-On Reset
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.
PTP	Picture Tube Panel (or CRT-panel)
RAM	Random Access Memory
RC	Remote Control handset
RC5	Remote Control system 5, signal from the remote control receiver
RGB	Red Green Blue
ROM	Read Only Memory
SAM	Service Alignment Mode
SAP	Second Audio Program
SC	Sandcastle: pulse derived from sync signals
S/C	Short Circuit
SCAVEM	Scan Velocity Modulation
SCL	Serial Clock
SDA	Serial Data
SDM	Service Default Mode
SECAM	SEequence Couleur Avec Memoire. Colour system mainly used in France and East Europe. Colour carriers = 4.406250 MHz and 4.250000 MHz
SIF	Sound Intermediate Frequency
SS	Small Screen
STBY	Standby
SVHS	Super Video Home System
SW	Software
THD	Total Harmonic Distortion
TXT	Teletext
µP	Microprocessor
UOC	Ultimate One Chip

VA	Vertical Acquisition
VBAT	Main supply voltage for the deflection stage (mostly 141 V)
V-chip	Violence Chip
VCR	Video Cassette Recorder
WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
XTAL	Quartz crystal
YC	Luminance (Y) and Chrominance (C) signal

Schematic notes



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Electrical Adjustments

REFER TO SAFETY GUIDELINES

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CAUTION: USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING

Alignments

Note: The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5. Menu navigation is done with the 'CURSOR UP, DOWN, LEFT or RIGHT' keys of the remote control transmitter.

General Alignment Conditions

Perform all electrical adjustments under the following conditions:

- AC voltage and frequency: 110 V (± 10 %), 60 Hz (± 5 %).
- Connect the set to the AC power via an isolation transformer.
- Allow the set to warm up for approximately 20 minutes.
- Measure the voltages and waveforms in relation to chassis ground (with the exception of the voltages on the primary side of the power supply). Never use the cooling fins / plates as ground.
- Test probe: Ri > 10 MΩ; Ci < 2.5 pF.
- Use an isolated trimmer / screwdriver to perform the alignments.

Hardware Alignments

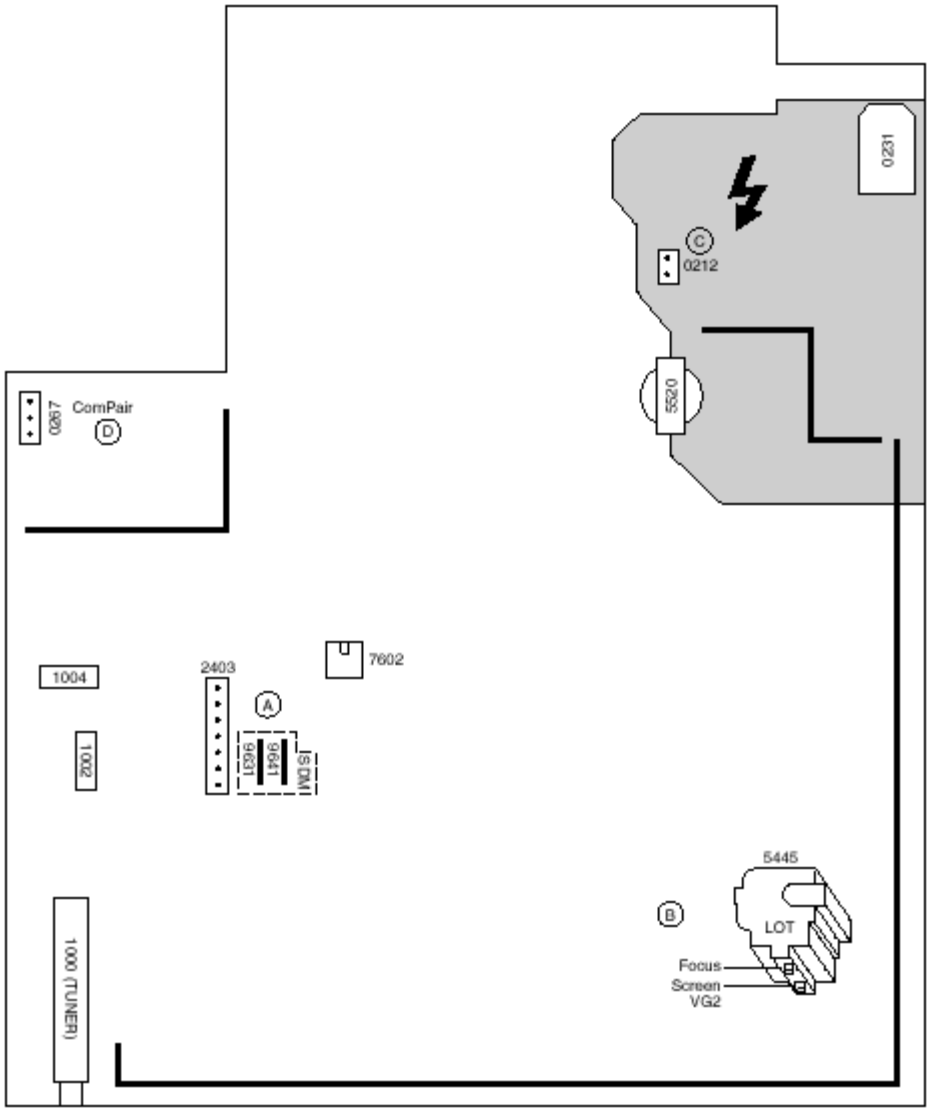


Fig. 1

Vg2 Adjustment

1. Activate the SAM.
2. Go to the WHITE TONE sub menu.
3. Set the values of NORMAL RED, GREEN and BLUE to 40.
4. Go, via the MENU key, to the normal user menu and set
   - CONTRAST to zero.
   - BRIGHTNESS to minimum (OSD just visible in a dark room).
5. Return to the SAM via the MENU key.
6. Connect the RF output of a pattern generator to the antenna input. Test pattern is a 'black' picture (blank screen on CRT without any OSD info).
7. Set the channel of the oscilloscope to 50 V/div and the time base to 0.2 ms (external triggering on the vertical pulse).
8. Ground the scope at the CRT panel and connect a 10:1 probe to one of the cathodes of the picture tube socket (see diagram B).

9. Measure the cut off pulse during first full line after the frame blanking (see Fig. 2). You will see two pulses, one being the cut off pulse and the other being the white drive pulse. Choose the one with the lowest value, this is the cut off pulse.
10. Select the cathode with the highest V_{DC} value for the alignment. Adjust the V_{cutoff} of this gun with the SCREEN potentiometer (see Fig. 1) on the LOT to the correct value (see table below).
11. Restore BRIGHTNESS and CONTRAST to normal (= 31).

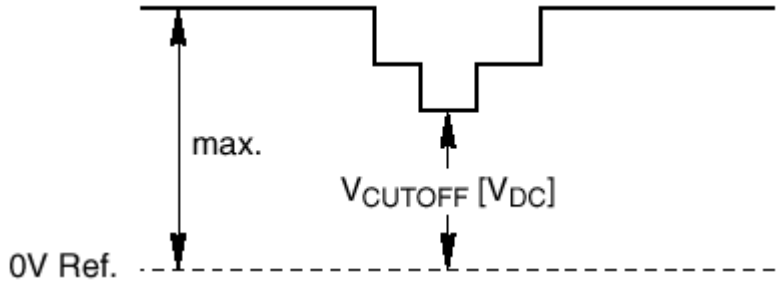


Fig. 2

Screen size	Cut-off [V]
13V, 14", 14RF, 15RF, 17", 19V, 20"	140 ± 4
21" (L8)	150 ± 4
21" (M8), 20RF, 21RF, 24WS, 25BLD, 25HF, 28 BLD, 28WS	125 ± 4
25V, 25BLS, 25RF, 27V, 28BLS, 29", 29RF, 32V, 33", 32WS, 35V	145 ± 10

Focusing

1. Tune the set to a circle or crosshatch test pattern (use an external video pattern generator).
2. Choose picture mode NATURAL (or MOVIES) with the 'SMART PICTURE' button on the remote control transmitter.
3. Adjust the FOCUS potentiometer (see Fig. 1) until the vertical lines at 2/3 from east and west, at the height of the centerline, are of minimum width without visible haze.

Software Alignments And Settings

Enter the Service Alignment Mode (see ***Service Modes, Error Codes and Faultfinding).*** The SAM menu will now appear on the screen.
Select one of the following alignments:

Options

Display Option Byte Chart

Options are used to control the presence / absence of certain features and hardware.

How to change an Option Byte

An Option Byte represents a number of different options.
Changing these bytes directly makes it possible to set all options very fast. All options are controlled via seven option bytes. Select the option byte (OB1.. OB7) with the MENU UP/DOWN keys, and enter the new value.
Leaving the OPTION submenu saves changes in the Option Byte settings. Some changes will only take effect after the set has been switched OFF and ON with the AC power switch (cold start).

How to calculate the value of an Option Byte

Calculate an Option Byte value (OB1 .. OB7) in the following way:

1. Check the status of the single option bits (OP): are they enabled (1) or disabled (0).
2. When an option bit is enabled (1) it represents a certain value (see column 'Dec. value' in table below). When an option bit is disabled, its value is 0.
3. The total value of an Option Byte is formed by the sum of its eight option bits.

OPTION BYTE STRUCTURE									
Bit	7	6	5	4	3	2	1	0	TOTAL VALUE
Dec. value	128	64	32	16	8	4	2	1	
OB1	OP17	OP16	OP15	OP14	OP13	OP12	OP11	OP10	Sum (OP10 to OP17)
OB2	OP27	OP26	OP25	OP24	OP23	OP22	OP21	OP20	Sum (OP20 to OP27)
OB3	OP37	OP36	OP35	OP34	OP33	OP32	OP31	OP30	Sum (OP30 to OP37)
OB4	OP47	OP46	OP45	OP44	OP43	OP42	OP41	OP40	Sum (OP40 to OP47)
OB5	OP57	OP56	OP55	OP54	OP53	OP52	OP51	OP50	Sum (OP50 to OP57)
OB6	OP67	OP66	OP65	OP64	OP63	OP62	OP61	OP60	Sum (OP60 to OP67)
OB7	OP77	OP76	OP75	OP74	OP73	OP72	OP71	OP70	Sum (OP70 to OP77)

Option Bit Assignment

Following are the option bit assignments for all L01 software clusters.

- Option Byte 1 (OB1)
  - OP10: CHINA
  - OP11: VIRGIN_MODE
  - OP12: UK_PNP
  - OP13: ACI

  - OP14: ATS
  - OP15: LNA
  - OP16: FM_RADIO
  - OP17: PHILIPS_TUNER
- Option Byte 2 (OB2)
  - OP20: HUE
  - OP21: COLOR_TEMP
  - OP22: CONTRAST_PLUS
  - OP23: TILT
  - OP24: NOISE_REDUCTION
  - OP25: CHANNEL_NAMING
  - OP26: SMART_PICTURE
  - OP27: SMART_SOUND
- Option Byte 3 (OB3)
  - OP30: AVL
  - OP31: WSSB
  - OP32: WIDE_SCREEN
  - OP33: SHIFT_HEADER_SUBTITLE
  - OP34: CONTINUOUS_ZOOM
  - OP35: COMPRESS_16_9
  - OP36: EXPAND_4_3
  - OP37: EW_FUNCTION
- Option Byte 4 (OB4)
  - OP40: STEREO_NON_DBX
  - OP41: STEREO_DBX
  - OP42: STEREO_PB
  - OP43: STEREO_NICAM_2CS
  - OP44: DELTA_VOLUME
  - OP45: ULTRA_BASS
  - OP46: VOLUME_LIMITER
  - OP47: INCR_SUR
- Option Byte 5 (OB5)
  - OP50: PIP
  - OP51: HOTEL_MODE
  - OP52: SVHS
  - OP53: CVI
  - OP54: AV3
  - OP55: AV2
  - OP56: AV1
  - OP57: NTSC_PLAYBACK
- Option Byte 6 (OB6)
  - OP60: Reserved (value = 0)
  - OP61: SMART_TEXT
  - OP62: SMART_LOCK
  - OP63: VCHIP
  - OP64: WAKEUP_CLOCK
  - OP65: SMART_CLOCK
  - OP66: SMART_SURF
  - OP67: PERSONAL_ZAPPING

- Option Byte 7 (OB7)
  - OP70: SOUND_SYSTEM_AP_3 /MULTI_STANDARD_EUR / SYSTEM_LT_2
  - OP71: SOUND_SYSTEM_AP_2 / WEST_EU/ SYSTEM_LT_1
  - OP72: SOUND_SYSTEM_AP_1
  - OP73: COLOR_SYSTEM_AP
  - OP74: Reserved (value = 0)
  - OP75: Reserved (value = 0)
  - OP76: TIME_WIN2
  - OP77: TIME_WIN1

Option bit definition

- OP10: CHINA
  0 : Tuning is not for China set, or this option bit is not applicable,
  1 : Tuning is for China set,
  Default setting : 0.
- OP11: VIRGIN_MODE 0 :
  Virgin mode is disabled or not applicable,
  1 : Virgin mode is enabled. Plug and Play menu item will be displayed to perform installation at the initial startup of the TV when VIRGIN_MODE is set to 1. After installation is finished, this option bit will be automatically set to 0,
  Default setting : 0.
- OP12: UK_PNP
  0 : UK's default Plug and Play setting is not available or not applicable, 1 : UK's default Plug and Play setting is available. When UK_PNP and VIRGIN_MODE are set to 1 at the initial setup, LANGUAGE = ENGLISH, COUNTRY = GREAT BRITAIN and after exiting from menu, VIRGIN_MODE will be set automatically to 0 while UK_PNP remains 1,
  Default setting : 0.
- OP13: ACI
  0 : ACI feature is disabled or not applicable,
  1 : ACI feature is enabled,
  Default setting : 0.
- OP14: ATS
  0 : ATS feature is disabled or not applicable, 1 : ATS feature is enabled. When ATS is enabled, it sorts the program in an ascending order starting from program 1,
  Default setting : 0.
- OP15: LNA
  0 :Auto Picture Booster is not available or not applicable,
  1: Auto Picture Booster is available,
  Default setting : 0.
- OP16: FM_RADIO
  0 : FM radio feature is disabled or not applicable,
  1 : FM radio feature is enabled,
  Default setting : 0.
- OP17: PHILIPS_TUNER
  0 : ALPS / MASCO compatible tuner is in use,
  1 : Philips compatible tuner is in use,
  Default setting : 0.
- OP20: HUE
  0 : Hue/Tint Level is disabled or not applicable,

1 : Hue/Tint Level is enabled,
Default setting : 0.

- OP21: COLOR_TEMP
  0 : Color Temperature is disabled or not applicable,
  1 : Color Temperature is enabled,
  Default setting : 0.
- OP22: CONTRAST_PLUS
  0 : Contrast+ is disabled or not applicable,
  1 : Contrast+ is enabled,
  Default setting : 0.
- OP23: TILT
  0 : Rotate Picture is disabled or not applicable,
  1 : Rotate Picture is enabled,
  Default setting : 0.
- OP24: NOISE_REDUCTION
  0 : Noise Reduction (NR) is disabled or not applicable,
  1 : Noise Reduction (NR) is enabled,
  Default setting : 0.
- OP25: CHANNEL_NAMING
  0 : Name FM Channel is disabled or not applicable,
  1 : Name FM Channel is enabled,
  Default setting : 0.
  Note : Name FM channel can be enabled only when FM_RADIO = 1.
- OP26: SMART_PICTURE
  0 : Smart Picture is disabled or not applicable,
  1 : Smart Picture is enabled,
  Default setting : 1
- OP27: SMART_SOUND
  0 : Smart Sound is disabled or not applicable,
  1 : Smart Sound is enabled,
  Default setting : 1
- AP30: AVL
  0 : AVL is disabled or not applicable,
  1 : AVL is enabled,
  Default setting : 0.
- OP31: WSSB
  0 : WSSB is disabled or not applicable,
  1 : WSSB is enabled,
  Default setting : 0.
  Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.
- OP32: WIDE_SCREEN
  0 : Software is used for 4:3 set or not applicable,
  1 : Software is used for 16:9 set,
  Default setting : 0.
- OP33: SHIFT_HEADER_SUBTITLE
  0 : Shift Header / Subtitle is disabled or not applicable,
  1 : Shift Header / Subtitle is enabled,
  Default setting : 0.
  Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.

- OP34: CONTINUOUS_ZOOM
  0 : Continuous Zoom is disabled or not applicable,
  1 : Continuous Zoom is enabled,
  Default setting : 0.
  Note : This option bit can be set to 1 only when WIDE_SCREEN = 1.
- OP35: COMPRESS_16_9
  0 : COMPRESS 16:9 selection is not applicable. Item should not be in the FORMAT menu list,
  1 : COMPRESS 16:9 selection is applicable. Item should not be in the FORMAT menu list,
  Default setting : 0.
- OP36: EXPAND_4_3
  0 : Expand 4:3 selection is not applicable. Item should not be in the FORMAT menu list,
  1 : Expand 4:3 selection is applicable. Item should be in the FORMAT menu list,
  Default setting : 0.
- OP37: EW_FUNCTION
  0 : EW function is disabled. In this case, only Expand 4:3 is allowed, Compress 16:9 is not applicable.
  1 : EW function is enabled. In this case, both Expand 4:3 and Compress 16:9 are applicable.
  Default setting : 0.
- OP40: STEREO_NON_DBX
  0 : For AP_NTSC, chip TDA 9853 is not present,
  1 : For AP_NTSC, chip TDA 9853 is present,
  Default setting : 0.
- OP41: STEREO_DBX
  0 : For AP_NTSC, chip MSP 3445 is not present,
  1 : For AP_NTSC, chip MSP 3445 is present, Default setting : 0.
- OP42: STEREO_PB
  0 : For AP_PAL, chip MSP3465 is not present,
  1 : For AP_PAL, chip MSP3465 is present,
  Default setting : 0.
- OP43: STEREO_NICAM_2CS
  0 : For EU and AP_PAL, chip MSP 3415 is not present,
  1 : For EU and AP_PAL, chip MSP 3415 is present,
  Default setting : 0.
- OP44: DELTA_VOLUME
  0 : Delta Volume Level is disabled or not applicable,
  1 : Delta Volume Level is enabled,
  Default setting : 0.
- OP45: ULTRA_BASS
  0 : Ultra Bass is disabled or not applicable,
  1 : Ultra Bass is enabled,
  Default setting : 0.
- OP46: VOLUME_LIMITER
  0 : Volume Limiter Level is disabled or not applicable,
  1 : Volume Limiter Level is enabled,
  Default setting : 0.
- OP47: INCR_SUR
  0 : Incredible Surround feature is disabled,
  1 : Incredible Surround feature is enabled,
  Default setting : 1
- OP50: PIP

0 : PIP is disabled or not applicable,
1 : PIP is enabled,
Default setting : 0.

- OP51: HOTEL_MODE
  0 : Hotel mode is disabled or not applicable,
  1 : Hotel mode is enabled,
  Default setting : 0.
- OP52: SVHS
  0 : SVHS source is not available,
  1 : SVHS source is available,
  Default setting : 0.
  Note : This option bit is not applicable for EU.
- OP53: CVI
  0 : CVI source is not available,
  1 : CVI source is available,
  Default setting : 0.
- OP54: AV3
  0 : Side/Front AV3 source is not present,
  1 : Side/Front AV3 source is present,
  Default setting : 0.
- OP55: AV2
  0 : AV2 source is not present,
  1 : AV2 source is present,
  Default setting : 0.
  Note : For EU, when AV2=1, both EXT2 and SVHS2 should be included in the OSD loop.
- OP56: AV1
  0 : AV1 source is not present,
  1 : AV1 source is present,
  Default setting : 0.
- OP57: NTSC_PLAYBACK
  0 : NTSC playback feature is not available,
  1 : NTSC playback feature is available,
  Default setting : 0.
- OP60: Reserved
  Default setting : 0.
- OP61: SMART_TEXT
  0 : Smart Text Mode and Favorite Page are disabled or not applicable,
  1 : Smart Text Mode and Favorite Page are enabled,
  Default setting : 1.
- OP62: SMART_LOCK
  0 : Child Lock and Lock Channel are disabled or not applicable for EU,
  1 : Child Lock and Lock Channel are enabled for EU,
  Default setting : 1.
- OP63: VCHIP
  0 : VCHIP feature is disabled,
  1 : VCHIP feature is enabled,
  Default setting : 1.
- OP64: WAKEUP_CLOCK
  0 : Wake up clock feature is disabled or not applicable,

1 : Wake up clock feature is enabled,
Default setting : 1.

- OP65: SMART_CLOCK
  0 : Smart Clock Using Teletext and Smart Clock Using PBS is disabled or not applicable,
  1 : Smart Clock Using Teletext and Smart Clock Using PBS is enabled. For NAFTA, menu item AUTOCHRON is present in the INSTALL submenu,
  Default setting : 0.
- OP66: SMART_SURF
  0 : Smart Surf feature is disabled or not applicable,
  1 : Smart Surf feature is enabled,
  Default setting : 0.
- OP67: PERSONAL_ZAPPING
  0 : Personal Zapping feature is disabled or not applicable,
  1 : Personal Zapping feature is enabled,
  Default setting : 0.
- OP70: MULTI_STANDARD_EUR
  0 : Not for Europe multi standard set, or this option bit is not applicable,
  1 : For Europe multi standard set.
  Default setting : 0.
  Note : This option bit is used to control the SYSTEM selection in Manual Store : If MULTI_STANDARD_EUR = 1 then SYSTEM = Europe, West Europe, East Europe, UK, France otherwise SYSTEM = 'Europe, West Europe, UK for West Europe' (WEST_EU=1) or SYSTEM = 'Europe, West Europe, East Europe for East Europe' (WEST_EU=0)
- OP71: WEST_EU
  0 : For East Europe set, or this option bit is not applicable,
  1 : For West Europe set,
  Default setting : 0.
- OP71 and 70: SYSTEM_LT_1, SYSTEM_LT_2
  These two option bits are allocated for LATAM system selection.
  00 : NTSC-M
  01 : NTSC-M, PAL-M
  10 : NTSC-M, PAL-M, PAL-N
  11 : NTSC-M, PAL-M, PAL-N, PAL-BG
  Default setting : 00
- OP70, 71 and 72: SOUND_SYSTEM_AP_1, SOUND_SYSTEM_AP_2, SOUND_SYSTEM_AP_3
  These three option bits are allocated for AP_PAL sound system selection.
  000 : BG
  001 : BG / DK
  010 : I / DK
  011 : BG / I / DK
  100 : BG / I / DK / M
  Default setting : 00
- OP73: COLOR_SYSTEM_AP
  This option bit is allocated for AP-PAL color system selection.
  0 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58
  1 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58, SECAM
  Default setting : 0
- OP74: Reserved
  Default setting : 0.

- OP75: Reserved
  Default setting : 0.
- OP77 and 76: TIME_WIN1, TIME_WIN2
  00 :The time window is set to 1.2s
  01 : The time window is set to 2s
  10 : The time window is set to 5s
  11 : not in use
  Default setting : 01
  Note :The time-out for all digit entries depend on this setting.

Tuner

Note: Described alignments are only necessary when the NVM (item 7602) is replaced.

IF PLL

This adjustment is auto-aligned. Therefore, no action is required.

AFW (AFC window)

Fixed value is OFF.

AGC (AGC take over point)

Set the external pattern generator to a color bar video signal and connect the RF output to aerial input. Set amplitude to 10 mV and set frequency to 61.25 MHz (channel 3).
Connect a DC multimeter to pin 1 of the tuner (item 1000 on the main panel).

1. Activate the SAM.
2. Go to the TUNER sub menu.
3. Select AFW with the UP/DOWN cursor keys and set to ON.
4. Select AGC with the UP/DOWN cursor keys.
5. Adjust the AGC-value (default value is 27) with the LEFT/RIGHT cursor keys until the voltage at pin 1 of the tuner lies between 3.8 and 2.3 V.
6. Select AFW with the UP/DOWN cursor keys and set to OFF.
7. Switch the set to STANDBY.

YD (Y-delay adjustment)

Always set to 3.

CL (Cathode drive level)

Always set to 4.

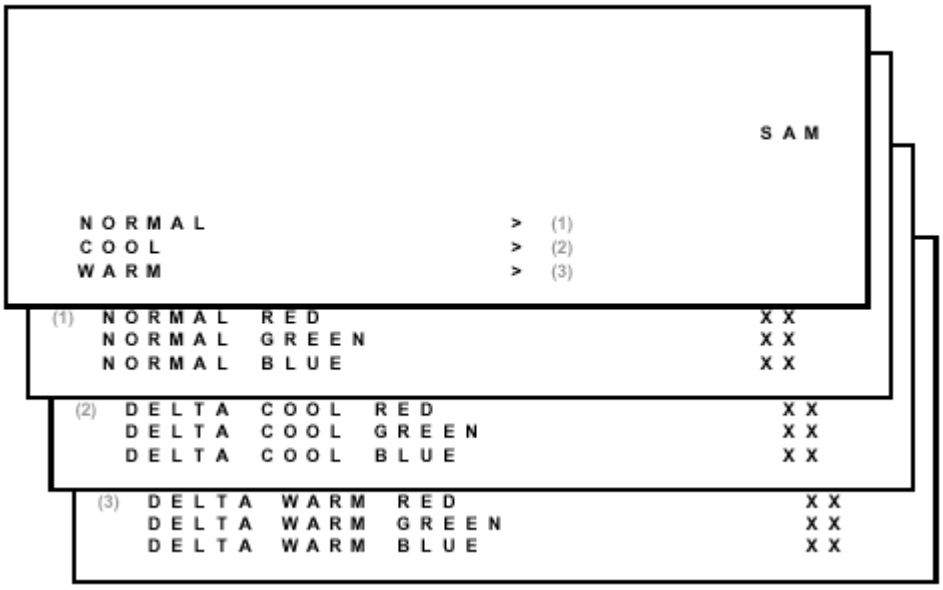
AFA

Read only bit, for monitoring purpose only.

AFB

Read only bit, for monitoring purpose only.

White Tone



In the WHITE TONE sub menu, the values of the black cut off level can be adjusted. Normally, no alignment is needed for the WHITE TONE. You can use the given default values.
The color temperature mode (NORMAL, COOL and WARM) and the color (R, G, and B) can be selected with the UP/DOWN RIGHT/LEFT cursor keys. The value can be changed with the LEFT/RIGHT cursor keys. First, select the values for the NORMAL color temperature. Then select the values for the COOL and WARM mode. After alignment, switch the set to standby, in order to store the alignments.
Default settings:

1. **NORMAL** (color temperature = 10500 K):
   - NORMAL R = 40
   - NORMAL G = 40
   - NORMAL B = 40
2. **COOL** (color temperature = 14000 K):
   - DELTA COOL R = -2
   - DELTA COOL G = 0
   - DELTA COOL B = 6
3. **WARM** (color temperature = 8200 K):
   - DELTA WARM R = 2
   - DELTA WARM G = 0
   - DELTA WARM B = -7

Geometry

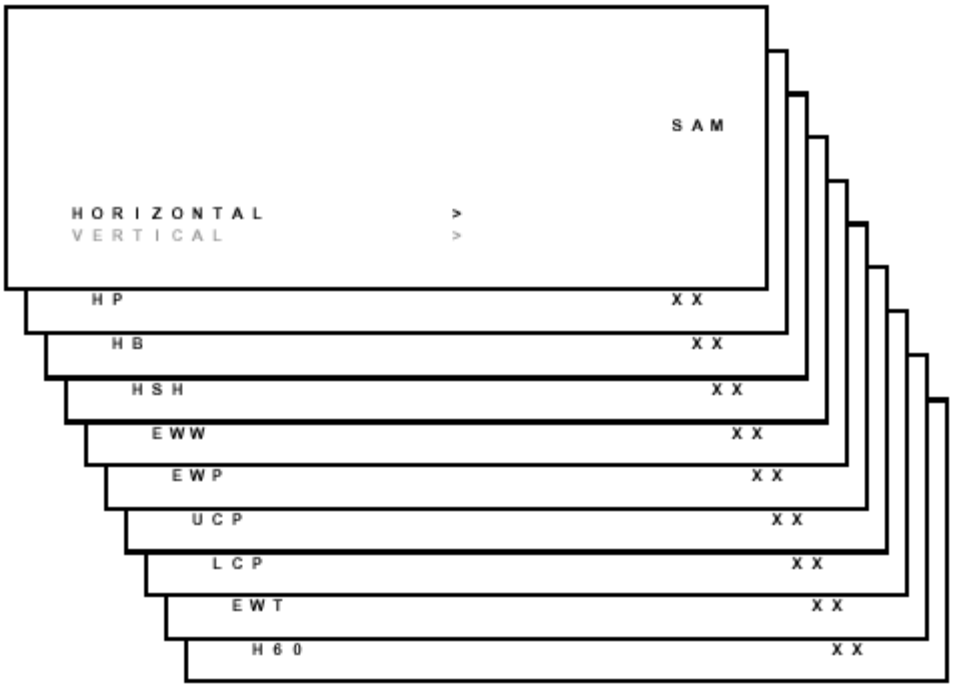
The geometry alignments menu contains several items to align the set, in order to obtain a correct picture geometry.

Connect an external video pattern generator to the aerial input of the TV-set and input a crosshatch test pattern. Set the generator amplitude to at least 1 mV and set frequency to 61.25 MHz (channel 3).

1. Set 'Smart Picture' to NATURAL (or MOVIES).

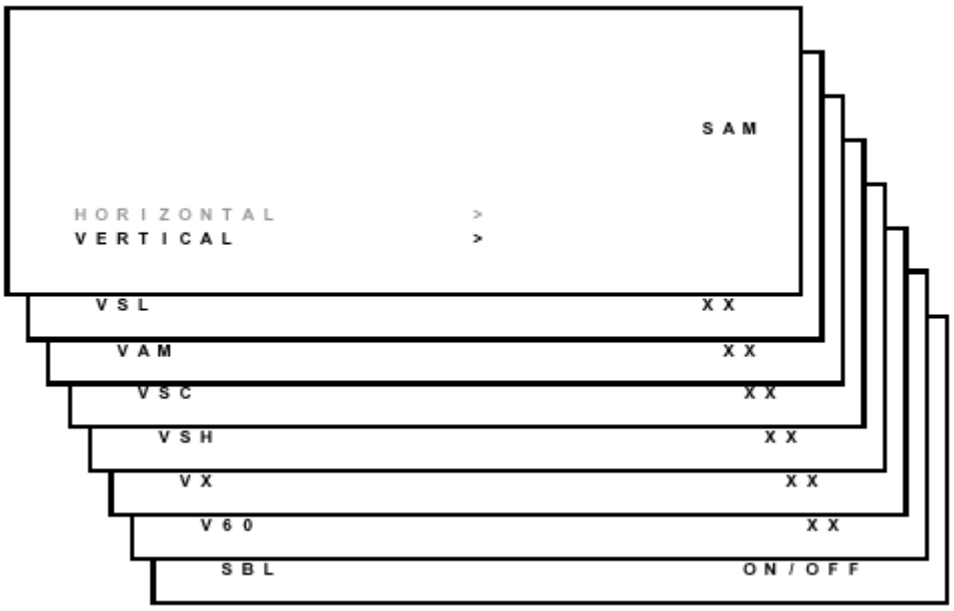
2. Activate the SAM menu (see ***Service Modes, Error Codes and Faultfinding***).
3. Go to the GEOMETRY sub menu.
4. Choose HORIZONTAL or VERTICAL alignment

Now the following alignments can be performed:



Horizontal:

- **Horizontal Parallelogram (HP)** Align straight vertical lines in the top and the bottom; vertical rotation around the center.
- **Horizontal Bow (HB)** Align straight horizontal lines in the top and the bottom; horizontal rotation around the center.
- **Horizontal Shift (HSH)** Align the horizontal center of the picture to the horizontal center of the CRT.
- **East West Width (EWW)** Align the picture width until the complete test pattern is visible.
- **East West Parabola (EWP)** Align straight vertical lines at the sides of the screen.
- **Upper Corner Parabola (UCP)** Align straight vertical lines in the upper corners of the screen.
- **Lower Corner Parabola (LCP)** Align straight vertical lines in the lower corners of the screen.
- **East West Trapezium (EWT)** Align straight vertical lines in the middle of the screen.
- **H60** Align straight horizontal lines if NTSC system is used (60 Hz) i.s.o. PAL (50 Hz).



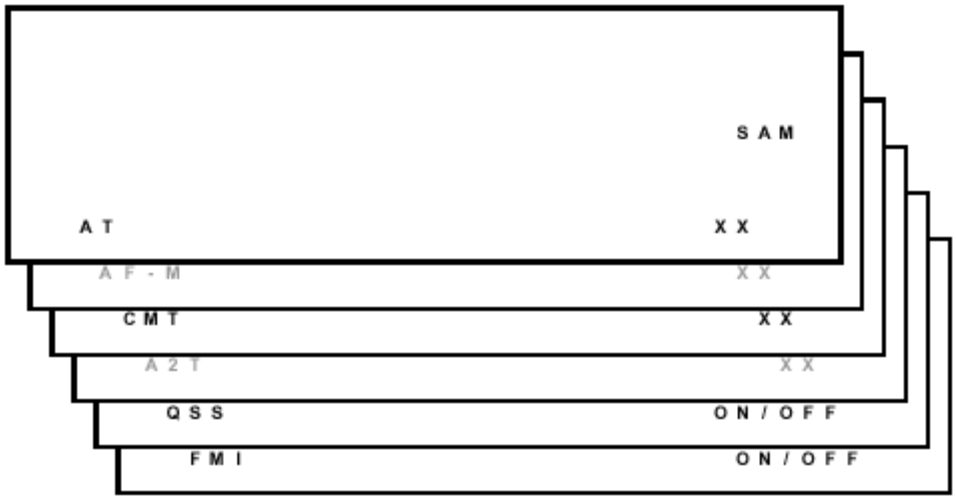
Vertical:

- **Vertical slope (VSL)** Align the vertical center of the picture to the vertical center of the CRT. This is the first of the vertical alignments to perform. For an easy alignment, set SBL to ON.
- **Vertical Amplitude (VAM)** Align the vertical amplitude so that the complete test pattern is visible.
- **Vertical S-Correction (VSC)** Align the vertical linearity, meaning that vertical intervals of a grid pattern must be equal over the entire screen height.
- **Vertical Shift (VSH)** Align the vertical centering so that the test pattern is located vertically in the middle. Repeat the 'vertical amplitude' alignment if necessary.
- **Vertical Zoom (VX)** The vertical zoom is added in for the purpose of development. It helps the designer to set a proper values for the movie expand or movie(16x9) compress. Default value is 25.
- **V60** Align straight vertical lines if NTSC system (60 Hz) is used i.s.o. PAL (50 Hz).
- **Service blanking (SBL)** Switch the blanking of the lower half of the screen ON or OFF (to be used in combination with the vertical slope alignment).

In the table below, you will find the GEOMETRY default values for the different sets.

DEFAULT GEOMETRY VALUES (L01 LARGE SCREEN)															
Alignment	Description	21''	20RF/21RF	24WS	25V	25''	25RF	28''	28WS	27V/29''	27RF/29RF	29''SF	32V/33''	32WS	35V
HP	Hor. Parallelogram	31	31	36	31	31	31	31	47	31	31	31	31	32	45
HB	Hor. Bow	31	31	32	31	31	31	31	32	31	31	31	31	32	25
HSH	Hor. Shift	35	35	27	35	35	35	35	27	35	35	35	35	24	23
EWW	East West Width	34	34	39	-	34	34	34	36	-	34	34	45	39	45
EWP	East West Parabola	33	33	26	-	33	33	33	21	-	33	33	23	21	23
UCP	Upper Corner Parabola	35	35	25	-	35	35	35	26	-	35	35	25	23	25
LCP	Lower Corner Parabola	35	35	25	-	35	35	35	30	-	35	35	31	30	31
EWT	East West Trapezium	35	35	30	-	35	35	35	28	-	35	35	24	26	24
VSL	Vert. Slope	33	33	42	25	33	33	33	42	25	33	33	19	35	19
VAM	Vert. Amplitude	26	26	20	32	26	26	26	30	32	26	26	31	23	31
VSC	Vert. S-correction	23	23	24	23	23	23	23	24	23	23	23	27	24	27
VSH	Vert. Shift	31	31	23	28	31	31	31	18	28	31	31	26	23	26
VX	Vert. Zoom	25	25	25	-	25	25	25	25	-	25	25	25	25	25
H60	Hor. Shift offset (60 Hz)	9	9	9	0	9	9	9	9	9	9	9	9	9	0
V60	Vert. Shift offset (60 Hz)	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	-2	-2	0
Abbreviations: V= visual, RF= Real Flat, SF= Super Flat, WS= Wide Screen (16:9)															

Audio



No alignments are needed for the audio sub menu. Use the given default values.

AT

Default value is 8.

CMT

Default value is 42.

QSS

OFF for mono sets, ON for stereo sets.

FMI

OFF for mono sets, ON for stereo sets.

Philips Consumer Electronics

Technical Service Data

Service and Quality
Service Publications Dept.
One Philips Drive
P.O. Box 14810
Knoxville, TN 37914

Manual 7603
Model no.: 29LL600121
First Publish: 5-10-2001
Rev. Date: 9-10-2001
Print Date: 11/21/2005

Training Information

REFER TO SAFETY GUIDELINES

SAFETY NOTICE: ANY PERSON ATTEMPTING TO SERVICE THIS CHASSIS MUST FAMILIARIZE HIMSELF WITH THE CHASSIS AND BE AWARE OF THE NECESSARY SAFETY PRECAUTIONS TO BE USED WHEN SERVICING ELECTRONIC EQUIPMENT CONTAINING HIGH VOLTAGES.

CAUTION: USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING

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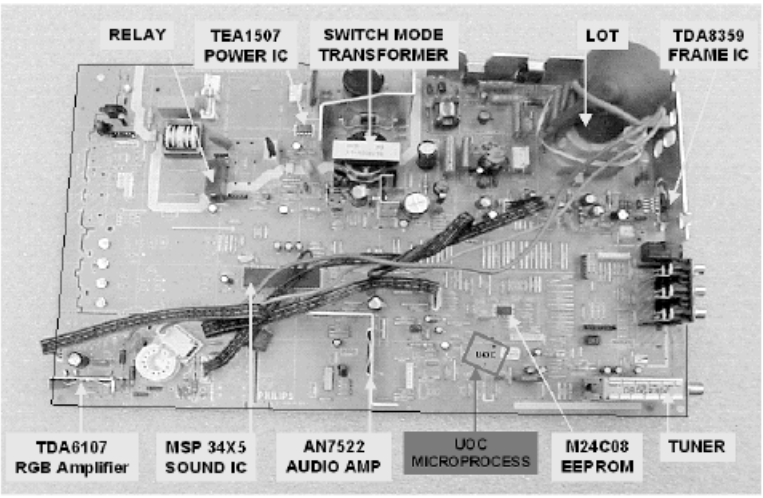
Circuit Description

Block Diagram
Test point overview Main Panel
Test point overview CRT Panel
I2C and Supply Voltage Diagram

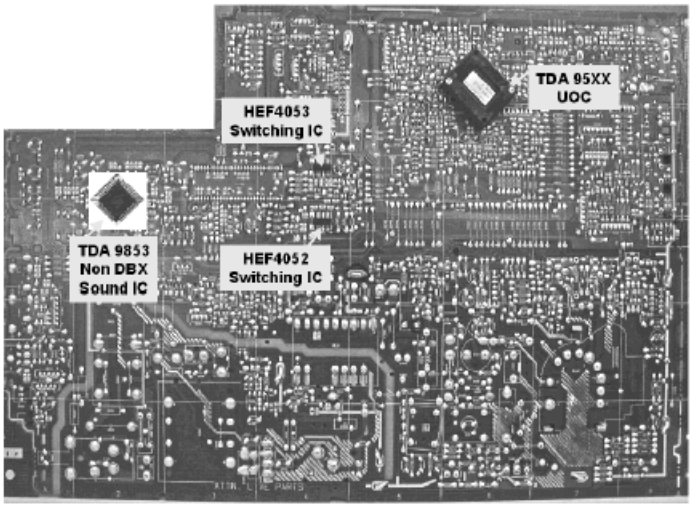
Note: For a good understanding of the following circuit descriptions, please use the block diagram or the electrical diagrams. Where necessary, you will find a separate drawing for clarification.

Introduction

The L8/M8 chassis is a global TV chassis for the model year 2001 and is used for TV sets with screen sizes from 25" - 36" (large screen), in Super Flat, Real Flat and Wide Screen executions.
The standard architecture consists of a Main panel, a Picture Tube panel, a Side I/O panel and a Top Control panel. In some executions, a Picture In Picture (PIP) panel is used.
The Main panel consists primarily of conventional components with hardly any surface mounted devices.



The functions for video processing, microprocessor (µP) and teletext (TXT) decoder are combined in one IC (TDA958xH), the so-called Ultimate One Chip (UOC). This chip is (surface) mounted on the copper side of the LSP.



The L8/M8 is divided into 2 basic systems, i.e. mono and stereo sound. While the audio processing for the mono sound is done in the audio block of the UOC, an external audio processing IC is used for stereo sets. The tuning system features 181 channels with on-screen display. The main tuning system uses a tuner, a microcomputer, and a memory IC mounted on the main panel.
The microcomputer communicates with the memory IC, the customer keyboard, remote receiver, tuner, signal processor IC and the audio output IC via the I^2C bus. The memory IC retains the settings for favorite stations, customer-preferred settings, and service / factory data. The on-screen graphics and closed caption decoding are done within the microprocessor, and then sent to the signal processor IC to be added to the main signal.
The chassis utilizes a Switching Mode Power Supply (SMPS) for the main voltage source. The chassis has a 'hot' ground reference on the primary side and a cold ground reference on the secondary side of the power supply and the rest of the chassis.

Audio Signal Processing

Stereo

In stereo sets, the signal goes via the SAW filter (position 1002), to the audio demodulator part of the UOC IC 7200. The audio output on pin 48 goes to the stereo decoder 7831 or 7861. The switch inside this IC selects either the internal decoder or an external source.
There are two stereo decoders used:
1. a BTSC DBX stereo/SAP decoder (MSP34X5 at position 7831) for the highest specified sets and
2. a BTSC non-DBX stereo decoder (TDA 9853 at position 7861) for BTSC Economic.

The output is fed to the to the audio amplifier (AN7522 at position 7901). The volume level is controlled at this IC (pin 9) by a control line (VolumeMute) from the microprocessor. The audio signal from 7901 is then sent to the speaker / headphone output panel.

Audio signal processing

Mono

In mono sets, the signal goes via the SAW filter (position 1002), to the audio demodulator part of the UOC IC 7200. The audio output on pin 48 goes, via the smart sound circuit (7941 for Bass and 7942 for Treble) and buffer 7943, to the audio amplifier (AN7523 at position 7902).
The volume level is controlled at this IC (pin 9) by a 'VolumeMute' control line from the microprocessor.
The audio signal from IC 7902 is then sent to the speaker / headphone output panel.

Mono set

Video Signal Processing

The processing circuits listed above are all integrated in the UOC TV processor. The surrounding components are for the adaptation of the selected application. The I^2C bus is for defining and controlling the signals.

RF signal processing

The incoming RF signal goes to the tuner (pos. 1000), where the 45.75 MHz IF signal is developed and amplified. The IF signals then exits the tuner from pin 11 to pass through the SAW filters (pos. 1002). The shaped signal is then applied to the IF processor part of the UOC (pos. 7200).
Tuner AGC (Automatic Gain Control) will reduce the tuner gain and thus the tuner output voltage when receiving strong RF signals. Adjust the AGC takeover point via the Service Alignment Mode (SAM). The tuner AGC starts working when the video-IF input reaches a certain input level. Adjust this level via the I^2C bus. The tuner AGC signal goes to the tuner (pin 1) via the open collector output (pin 22) of the UOC.
The IC also generates an Automatic Frequency Control (AFC) signal that goes to the tuning system via the I^2C bus, to provide frequency correction when needed. The demodulated composite video signal is available at pin 38 and then buffered by transistor 7201.

Video source selection

The Composite Video Blanking Signal (CVBS) from buffer 7201 goes to the audio carrier trap filters (1200, 1201, or 1202 depending on the system used) to remove the audio signal. The signal then goes to pin 40 of IC 7200. The internal input switch selects the following input signals:

- Pin 40: terrestrial CVBS input
- Pin 42: external AV1 CVBS input
- Pin 44: external Side I/O CVBS or AV2 Luminance (Y) input

Once the signal source is selected, a chroma filter calibration is performed. The received color burst sub-carrier frequency is used for this. Correspondingly, the chroma band pass filter for PAL/NTSC processing or the cloche filter for SECAM processing is switched on. The selected luminance (Y) signal is supplied to the horizontal and vertical synchronization processing circuit and to the luminance processing circuit. In the luminance-processing block, the luminance signal goes to the chroma trap filter. This trap is switched 'on' or 'off' depending on the color burst detection of the chroma calibration circuit.
The group delay correction part can be switched between the BG and a flat group delay characteristic. This has the advantage that in multi-standard receivers no compromise has to be made for the choice of the SAW filter.

Figure 1

Video demodulation

The color decoder circuit detects whether the signal is a PAL, NTSC or SECAM signal. The result is made known to the auto system manager. The PAL/NTSC decoder has an internal clock generator, which is stabilized to the required frequency by using the 12 MHz clock signal from the reference oscillator of the microcontroller / teletext

decoder.
The base-band delay line is used to obtain a good suppression of cross color effects.
The Y signal and the delay line outputs U and V are applied to the luminance / chroma signal processing part of the TV processor.

Luminance / Chrominance signal processing

The output of the YUV separator is fed to the internal YUV switch, which switches between the output of the YUV separator or the external YUV (for DVD or PIP) on pins 51-53. Pin 50 is the input for the insertion control signal called 'FBL-1'. When this signal level becomes higher than 0.9 V (but less than 3 V), the RGB signals at pins 51, 52 and 53 are inserted into the picture by using the internal switches.
Also some picture improvement features are implemented in this part:

- **Black stretch** This function corrects the black level of incoming signals, which have a difference between the black level and the blanking level. The amount of extension depends upon the difference between actual black level and the darkest part of the incoming video signal level. It is detected by means of an internal capacitor.
- **White stretch** This function adapts the transfer characteristic of the luminance amplifier in a non-linear way depending on the average picture content of the luminance signal. It operates in such a way that maximum stretching is obtained when signals with a low video level are received. For bright pictures, stretching is not active.
- **Dynamic skin tone correction**This circuit corrects (instantaneously and locally) the hue of those colors which are located in the area in the UV plane that matches the skin tone. The correction is dependent on the luminance, saturation and distance to the preferred axis.

The YUV signal is then fed to the color matrix circuit, which converts it to R, G and B signals. The OSD/TXT signal from the microprocessor is mixed with the main signal at this point, before being output to the CRT board (pins 56, 57 and 58).

Picture in picture (if present)

The PIP controller M65669FP is an NTSC video processor for TV applications. It contains all of the analog signal processing, control logic and memory, necessary to provide sub-picture insertion from a second, non-synchronized, video source into the main picture of the TV. This can be an external source (via the rear I/O inputs) or the video signal of the tuner.
Sync signals are derived from the sandcastle signal and separated by circuit 7171-7174 on the PIP-interface, and then fed to pins 32 and 33 of the PIP processor 7803.

RGB control

The RGB control circuit enables the picture parameters contrast, brightness and saturation to be adjusted, by using a combination of the user menus and the remote control.
Additionally automatic gain control for the RGB signals via cut-off stabilization is achieved in this functional block to obtain an accurate biasing of the picture tube. Therefor this block inserts the cut-off point measuring pulses into the RGB signals during the vertical retrace period.
The following additional controls are used:

- **Black current calibration loop** Because of the 2-point black current stabilization circuit, both the black level and the amplitude of the RGB output signals depend on the drive characteristics of the picture tube. The system checks whether the returning measuring currents meet the requirements, and adapt the output level and gain of

the circuit when necessary. After stabilization of the loop, the RGB drive signals are switched on. The 2-point black level system adapts the drive voltage for each cathode in such a way that the two measuring currents have the right value. This is done with the measurement pulses during the frame flyback. During the first frame, three pulses with a current of 8 µA are generated to adjust the cut off voltage. During the second frame, three pulses with a current of 20 µA are generated to adjust the 'white drive'. This has as a consequence, that a change in the gain of the output stage will be compensated by a gain change of the RGB control circuit. Pin 55 (BLKIN) of the UOC is used as the feedback input from the CRT base panel.

- **Blue stretch** This function increases the color temperature of the bright scenes (amplitudes which exceed a value of 80% of the nominal amplitude). This effect is obtained by decreasing the small signal gain of the red and green channel signals, which exceed this 80% level.
- **Beam current limiting** A beam current limiting circuit inside the UOC handles the contrast and brightness control for the RGB signals. This prevents the CRT from being overdriven, which could otherwise cause serious damage in the line output stage. The reference used for this purpose is the DC voltage on pin 54 (BLCIN) of the TV processor. Contrast and brightness reduction of the RGB output signals is therefore proportional to the voltage present on this pin. Contrast reduction starts when the voltage on pin 54 is lower than 2.8 V. Brightness reduction starts when the voltage on pin 54 is less than 1.7 V. The voltage on pin 54 is normally 3.3 V (limiter not active). During set switch-off, the black current control circuit generates a fixed beam current of 1 mA. This current ensures that the picture tube capacitance is discharged. During the switch-off period, the vertical deflection is placed in an over-scan position, so that the discharge is not visible on the screen.

RGB amplifier

From outputs 56, 57 and 58 of IC 7200 the RGB signals are applied to the integrated output amplifier (7330) on the CRT panel. Via the outputs 7, 8 and 9 the picture tube cathodes are driven.
The supply voltage for the amplifier is +200 V and is derived from the line output stage.

Synchronization

Inside IC 7200 part D the vertical and horizontal sync pulses are separated. These 'H' and 'V' signals are synchronised with the incoming CVBS signal. They are then fed to the H-and V-drive circuits and to the OSD/TXT circuit for synchronization of the On Screen Display and Teletext (CC) information.

Deflection

Horizontal drive

The horizontal drive signal is obtained from an internal VCO, which is running at twice the line frequency. This frequency is divided by two, to lock the first control loop to the incoming signal.
When the IC is switched 'on', the 'Hdrive' signal is suppressed until the frequency is correct.
The 'Hdrive' signal is available at pin 30. The 'Hflybk' signal is fed to pin 31 to phase lock the horizontal oscillator, so that Q7462 cannot switch 'on' during the flyback time.
The 'EWdrive' signal for the E/W circuit (if present) is available on pin 15, where it drives transistor 7400 to make linearity corrections in the horizontal drive.
When the set is switched on, the '+8V' voltage goes to pin 9 of IC 7200. The horizontal drive starts up in a soft start mode.
It starts with a very short TON time of the horizontal output transistor. The TOFF of the transistor is identical to the

time in normal operation. The starting frequency during switch on is therefore about 2 times higher than the normal value. The 'on' time is slowly increased to the nominal value in 1175 ms.
When the nominal value is reached, the PLL is closed in such a way that only very small phase corrections are necessary. The 'EHTinformation' line on pin 11 is intended to be used as a 'X-ray' protection. When this protection is activated (when the voltage exceeds 6 V), the horizontal drive (pin 30) is switched 'off' immediately. If the 'H-drive' is stopped, pin 11 will become low again. Now the horizontal drive is again
switched on via the slow start procedure.
The 'EHTinformation' line (Aquadag) is also fed back to the UOC IC 7200 pin 54, to adjust the picture level in order to compensate for changes in the beam current.

The 'filament' voltage is monitored for 'no voltage' or 'excessive voltage'. This voltage is rectified by diode 6447 and fed to the emitter of transistor 7443. If this voltage goes above 6.8 V, transistor 7443 will conduct, making the 'EHT0' line 'high'. This will immediately switch off the horizontal drive (pin 30) via the slow stop procedure.
The horizontal drive signal exits IC 7200 at pin 30 and goes to 7462, the horizontal driver transistor. The signal is amplified and coupled to the base circuit of 7460, the horizontal output transistor. This will drive the line output transformer (LOT) and associated circuit. The LOT provides the extra high voltage (EHT), the VG2 voltage and the focus and filament voltages for the CRT, while the line output circuit drives the horizontal deflection coil.

Vertical drive

A divider circuit performs the vertical synchronization. The vertical ramp generator needs an external resistor (R3245, pin 20) and capacitor (C2244, pin 21). A differential output is available at pins 16 and 17, which are DC-coupled with the vertical output stage. During the insertion of RGB signals, the maximum vertical frequency is increased to 72 Hz so that the circuit can also synchronize on signals with a higher vertical frequency like VGA.
To avoid damage of the picture tube when the vertical deflection fails, the guard output is fed to the beam current limiting input. When a failure is detected the RGB-outputs are blanked. When no vertical deflection output stage is connected this guard circuit will also blank the output signals.
These 'V_DRIVE+' and 'V_DRIVE-' signals are applied to the input pins 1 and 2 of IC 7471 (full bridge vertical deflection amplifier). These are voltage driven differential inputs. As the driver device (IC 7200) delivers output currents, R3474 and R3475 convert them to voltage. The differential input voltage is compared with the voltage across measuring resistor R3471 that provides internal feedback information. The voltage across this measuring resistor is proportional to the output current, which is available at pins 4 and 7 where they drive the vertical deflection coil (connector 0222) in phase opposition.
IC 7471 is supplied by +13 V. The vertical flyback voltage is determined by an external supply voltage at pin 6 (VlotAux+50V). This voltage is almost totally available as flyback voltage across the coil, this being possible due to the absence of a coupling capacitor (which is not necessary, due to the 'bridge' configuration).

Deflection corrections

The linearity correction

A constant voltage on the horizontal deflection coil should result in a sawtooth current. This however is not the case as the resistance of the coil is not negligible. In order to compensate for this resistance, a pre-magnetised coil L5457 is used. R3485 and C2459 ensure that L5457 does not excite, because of its own parasite capacitance. This L5457 is called the 'linearity coil'.

The Mannheim effect

When clear white lines are displayed, the high-voltage circuit is heavily loaded. During the first half of the flyback, the

high voltage capacitors are considerable charged. At that point in time, the deflection coil excites through C2465. This current peak, through the high-voltage capacitor, distorts the flyback pulse. This causes synchronisation errors, causing an oscillation under the white line.
During t3 - t5, C2490//2458 is charged via R3459. At the moment of the flyback, C2490//2458 is subjected to the negative voltage pulses of the parabola as a result of which D6465 and D6466 are conducting and C2490//2458 is switched in parallel with C2456//2457. This is the moment the high-voltage diodes are conducting. Now extra energy is available for excitation through C2465 and the line deflection.
As a consequence the flyback pulse is less distorted.

The S-Correction

Since the sides of the picture are further away from the point of deflection than from the centre, a linear sawtooth current would result in a non-linear image being scanned (the center would be scanned slower than the sides). For the center-horizontal line, the difference in relation of the distances is larger then those for the top and bottom lines. An S-shaped current will have to be superimposed onto the sawtooth current. This correction is called finger-length correction or S-correction.
C2456//2457 is relatively small, as a result of which the sawtooth current will generate a parabolic voltage with negative voltage peaks. Left and right, the voltage across the deflection coil decreases, and the deflection will slow down; in the center, the voltage increases and deflection is faster.
The larger the picture width, the higher the deflection current through C2456//2457. The current also results in a parabolic voltage across C2484//2469, resulting in the fingerlength correction proportionally increasing with the picture width.
The east/west drive signal will ensure the largest picture width in the center of the frame. Here the largest correction is applied.

East/West correction

In the M8, there are three types of CRTs, namely the 100º, 110º and wide screen CRTs. The 100º CRT is raster-correction-free and does not need East/West correction.
The 110º4:3 CRT comes with East/West correction and East/West protection.
The wide screen TV sets have all the correction of the 110 4:3 CRT and also have additional picture format like the 4:3 format, 16:9, 14:9, 16:9 zoom, subtitle zoom and the Super- Wide picture format A line, written at the upper- or lower side of the screen, will be larger at the screen center when a fixed deflection current is used. Therefore the amplitude of the defelection current must be increased when the spot approaches the center of the screen. This is called the East/West or pincushion correction.
The 'Ewdrive' signal from pin 15 of IC 7200 takes care for the correct correction. It drives FET 7400. It also corrects breathing of the picture, due to beam current variations (the EHT varies dependent of the beam current). This correction is derived from the 'EHTinformation' line.
Two protections are built-in for the E/W circuit: over-current and over-voltage protection. See ***Luminance / Chrominance signal processing***.

Panorama

The panorama function is only used in 16:9 sets. This is a function to enable the 4:3 and Super-Wide feature. It drives the 'Bass_panorama' line, to activate relay 1400. When this relay is switched on, the capacitors 2453//2454 are added in parallel to the default S-correction capacitors 2456//2457.
This results in an increased capacitance, a lower resonance frequency of the line deflection coil and the S-correction capacitors and therefore a less steep S-corrected line deflection current.

Power Supply

Figure 1
Figure 2

Introduction

The supply is a Switching Mode Power Supply (SMPS). The frequency of operation varies with the circuit load. This 'Quasi-Resonant Flyback' behavior has some important benefits compared to a 'hard switching' fixed frequency Flyback converter. The efficiency can be improved up to 90%, which results in lower power consumption. Moreover the supply runs cooler and safety is enhanced.
The power supply starts operating when a DC voltage goes from the rectifier bridge via T5520, R3532 to pin 8. The operating voltage for the driver circuit is also taken from the 'hot' side of this transformer.
The switching regulator IC 7520 starts switching the FET 'on' and 'off', to control the current flow through the primary winding of transformer 5520. The energy stored in the primary winding during the 'on' time is delivered to the secondary windings during the 'off' time.
The 'MainSupply' line is the reference voltage for the power supply. It is sampled by resistors 3543 and 3544 and fed to the input of the regulator 7540 / 6540. This regulator drives the feedback optocoupler 7515 to set the feedback control voltage on pin 3 of 7520.

The power supply in the set is 'on' any time AC power goes to the set.

Derived Voltages

The voltages supplied by the secondary windings of T5520 are:

- 'MainAux' for the audio circuit (voltage depends on set execution, see table below),
- 3.3 V and 3.9 V for the microprocessor and
- 'MainSupply' for the horizontal output (voltage depends on set execution, see table below).

Other supply voltages are provided by the LOT. It supplies +50 V (only for large screen sets), +13 V, +8 V, +5 V and a +200 V source for the video drive. The secondary voltages of the LOT are monitored by the 'EHTinformation' lines. These lines are fed to the video processor part of the UOC IC 7200
on pins 11 and 34.
This circuit will shut 'off' the horizontal drive in case of over- voltage or excessive beam current.

Figure 3

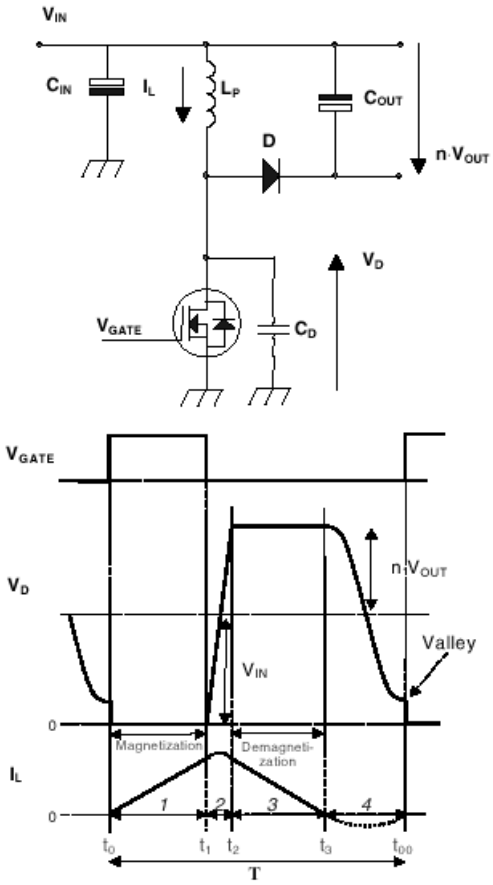
Power supply voltages				
Screen Size	Voltage name	Measuring point	Value	Remark
14", 15RF, 17", 20", 21"	MainSupply	P6 (C2561)	95 V	
	MainAux	P5 (C2564)	11 V	Stereo 2x3 W and Mono 1x2 W, 3 W, 4 W
			10 V	Stereo 2x1 W and Mono 1x1 W
All others	MainSupply	P6 (C2561)	130 V	21/25/29RF and 25/27/32/35V
			143 V	25/28/29SF, 25/28BLD, 25/28BLS, 28/32WS, 24/28BLDWS & BLSWS
	MainAux	P5 (C2564)	12 V	Stereo 2x1 W, 3 W, 5 W
			10 V	Mono 1x1 W

Degaussing

When the set is switched on, the degaussing relay 1515 is immediately activated as transistor 7580 is conducting. Due to the RC-time of R3580 and C2580, it will last about 3 to 4 seconds before transistor 7580 is switched off.

Basic IC Functionality

For a clear understanding of the Quasi-Resonant behavior, it is possible to explain it by a simplified circuit diagram (see Figure below). In this circuit diagram, the secondary side is transferred to the primary side and the transformer is replaced by an inductance LP. CD is the total drain capacitance including the resonance capacitor CR, parasitic output capacitor COSS of the MOSFET and the winding capacitance CW of the transformer. The turns ratio of the transformer is represented by n (NP/NS).



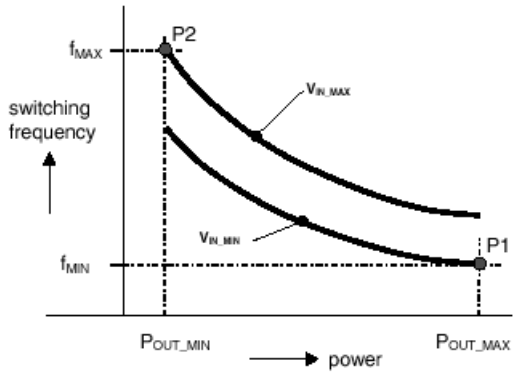
In the Quasi-Resonant mode each period can be divided into four different time intervals, in chronological order:

- **Interval 1: t0 < t < t1 primary stroke** At the beginning of the first interval, the MOSFET is switched 'on' and energy is stored in the primary inductance (magnetization). At the end, the MOSFET is switched 'off' and the second interval starts.
- **Interval 2: t1 < t < t2 commutation time** In the second interval, the drain voltage will rise from almost zero to VIN+n•(VOUT +VF). VF is the forward voltage drop of de diode that will be omitted from the equations from now on. The current will change its positive derivative, corresponding to VIN/LP, to a negative derivative, corresponding to -n•VOUT /LP.
- **Interval 3: t2 < t < t3 secondary stroke** In the third interval, the stored energy is transferred to the output, so the diode starts to conduct and the inductive current IL will decrease. In other words, the transformer will be demagnetized. When the inductive current has become zero the next interval begins.
- **Interval 4: t3 < t < t00 resonance time** In the fourth interval, the energy stored in the drain capacitor CD will start to resonate with the inductance LP. The voltage and current waveforms are sinusoidal waveforms. The drain voltage will drop from VIN+n•VOUT to VIN-n•VOUT.

Frequency Behavior

The frequency in the QR-mode is determined by the power stage and is not influenced by the controller (important parameters are LP and CD). The frequency varies with the input voltage VIN and the output power POUT. If the required output power increases, more energy has to be stored in the transformer. This leads to longer magnetizing tPRIM and demagnetizing tSEC times, which will decrease the frequency.
See the frequency versus output power characteristics below. The frequency characteristic is not only output power-, but also input voltage dependent. The higher the input voltage, the smaller tPRIM, so the higher the frequency will be.

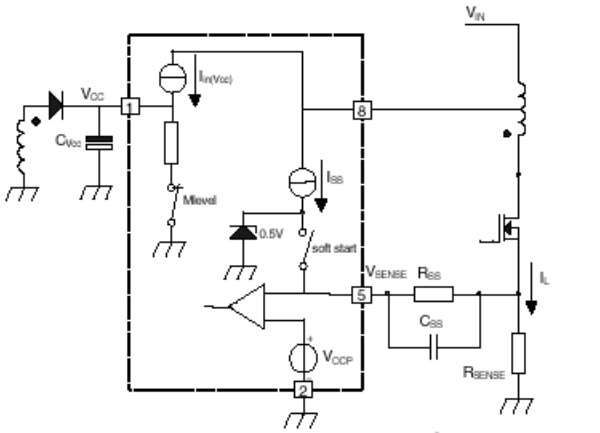
Point P1 is the minimum frequency fMIN that occurs at the specified minimum input voltage and maximum output power required by the application. Of course the minimum frequency has to be chosen above the audible limit (>20 kHz).



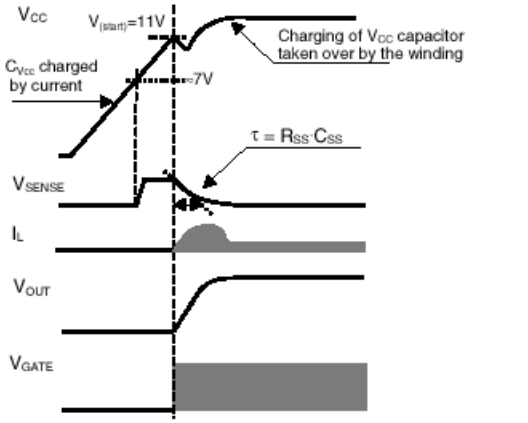
QR frequency characteristics at different input voltages

Start-Up Sequence

When the rectified AC voltage VIN (via the center tap connected to pin 8) reaches the Mains dependent operation level (Mlevel: between 60 and 100 V), the internal 'Mlevel switch' will be opened and the start-up current source is enabled to charge capacitor C2521 at the VCC pin as shown below.
The 'soft start' switch is closed when the VCC reaches a level of 7 V and the 'soft start' capacitor CSS (C2522, between pin 5 and the sense resistor R3526), is charged to 0.5 V.
Once the VCC capacitor is charged to the start-up voltage VCC-start (11 V), the IC starts driving the MOSFET. Both internal current sources are switched 'off' after reaching this start-up voltage. Resistor RSS (3524) will discharge the 'soft start' capacitor, such that the peak current will slowly increase. This to prevent 'transformer rattle'.
During start-up, the VCC capacitor will be discharged until the moment that the primary auxiliary winding takes over this voltage.



Start-up sequence

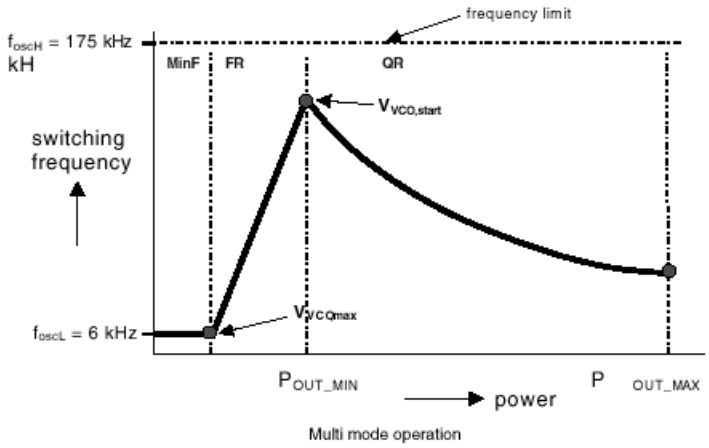


The moment that the voltage on pin 1 drops below the 'under voltage lock out' level (UVLO = ±9 V), the IC will stop switching and will enter a safe restart from the rectified mains voltage.

Operation

The supply can run in three different modes depending on the output power:

- **Quasi-Resonant mode (QR)** The QR mode, described above, is used during normal operation. This will give a high efficiency.
- **Frequency Reduction mode (FR)** The FR mode (also called VCO mode) is implemented to decrease the switching losses at low output loads. In this way the efficiency at low output powers is increased, which enables power consumption smaller than 3 W during stand-by. The voltage at the pin 3 (Ctrl) determines where the frequency reduction starts. An external Ctrl voltage of 1.425 V corresponds with an internal VCO level of 75 mV. This fixed VCO level is called VVCO,start .
  The frequency will be reduced in relation to the VCO voltage between 75 mV and 50 mV (at levels larger than 75 mV, Ctrl voltage < 1.425V, the oscillator will run on maximum frequency foscH = 175 kHz typically). At 50 mV (VVCO,max) the frequency is reduced to the minimum level of 6 kHz. Valley switching is still active in this mode.
- **Minimum Frequency mode (MinF)** At VCO levels below 50 mV, the minimum frequency will remain on 6 kHz, which is called the MinF mode. Because of this low frequency, it is possible to run at very low loads without having any output regulation problems.



Multi mode operation

Safe-Restart Mode

This mode is introduced to prevent the components from being destroyed during eventual system fault conditions. It is also used for the Burst mode. The Safe-Restart mode will be entered if it is triggered by one of the following functions:

- Over voltage protection,
- Short winding protection,
- Maximum 'on time' protection,
- VCC reaching UVLO level (fold back during overload),
- Detecting a pulse for Burst mode,
- Over temperature protection.

When entering the Safe-Restart mode, the output driver is immediately disabled and latched. The VCC winding will not charge the VCC capacitor anymore and the VCC voltage will drop until UVLO is reached. To recharge the VCC capacitor, the internal current source (I(restart)(VCC)) will be switched 'on' to initiate a new start-up sequence as described before. This Safe-Restart mode will persist until the controller detects no faults or burst triggers.

Standby

The set goes to Standby in the following cases:

- After pressing the 'standby' key on the remote control.
- When the set is in protection mode.

In Standby, the power supply works in 'burst mode'. Burst mode can be used to reduce the power consumption below 1 W at stand-by. During this mode, the controller is active (generating gate pulses) for only a short time and for a longer time inactive waiting for the next burst cycle.
In the active period the energy is transferred to the secondary and stored in the buffer capacitor CSTAB in front of the linear stabilizer (see Figure below). During the inactive period, the load (e.g. microprocessor) discharges this capacitor. In this mode, the controller makes use of the Safe-Restart mode.

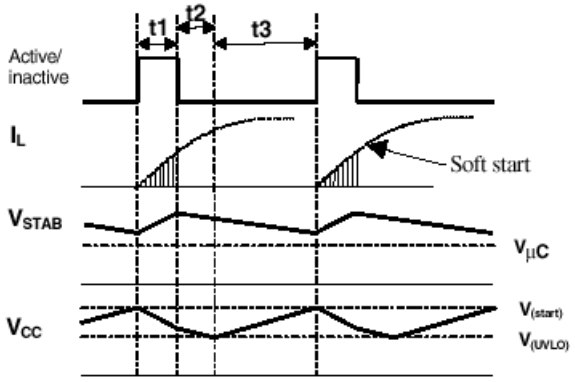
Basic Burst mode configuration

The system enters burst mode standby when the microprocessor activates the 'Stdby_con' line. When this line is pulled high, the base of Q7541 is allowed to go high. This is triggered by the current from collector Q7542. When Q7541 turns 'on', the opto-coupler (7515) is activated, sending a large current signal to pin 3 (Ctrl). In response to this signal, the IC stops switching and enters a 'hiccup' mode.
This burst activation signal should be present for longer than the 'burst blank' period (typically 30 ?s): the blanking

time prevents false burst triggering due to spikes.
Burst mode standby operation continues until the microcontroller pulls the 'Stdby_con' signal low again. The base of Q7541 is unable to go high, thus cannot turn 'on'.
This will disable the burst mode. The system then enters the start-up sequence and begins normal switching behavior.

For a more detailed description of one burst cycle, three time intervals are defined:

- **t1: Discharge of VCC when gate drive is active** During the first interval, energy is transferred, which result in a ramp-up of the output voltage (VSTAB) in front of the stabilizer. When enough energy is stored in the capacitor, the IC will be switched 'off' by a current pulse generated at the secondary side. This pulse is transferred to the primary side via the opto coupler. The controller will disable the output driver (safe restart mode) when the current pulse reaches a threshold level of 16 mA into the Ctrl pin. A resistor R1 (R3519) is placed in series with the opto coupler, to limit the current going into the Ctrl pin. Meanwhile the VCC capacitor is discharged but has to stay above VUVLO .
- **t2: Discharge of VCC when gate drive is inactive**
  During the second interval, the VCC is discharged to VUVLO. The output voltage will decrease depending on the load.
- **t3: Charge of VCC when gate drive is inactive** The third interval starts when the UVLO is reached. The internal current source charges the VCC capacitor (also the soft start capacitor is recharged). Once the VCC capacitor is charged to the start-up voltage, the driver is activated and a new burst cycle is started.



Burst mode waveforms

Protection Events

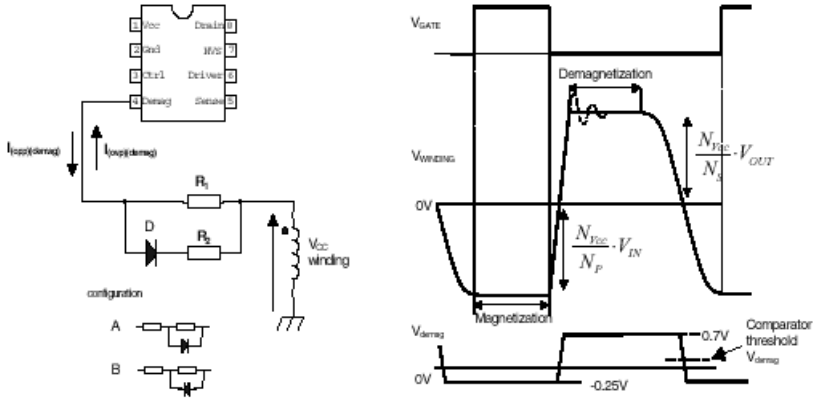
The SMPS IC 7520 has the following protection features:

Demagnetization sense

This feature guarantees discontinuous conduction mode operation in every situation. The oscillator will not start a new primary stroke until the secondary stroke has ended. This is to ensure that FET 7521 will not turn on until the demagnetization of transformer 5520 is complete.The function is an additional protection feature against:

- saturation of the transformer,
- damage of the components during initial start-up,
- an overload of the output.

The demag(netization) sense is realized by an internal circuit that guards the voltage (Vdemag) at pin 4 that is connected to VCC winding by resistor R1 (R3522). The Figure below shows the circuit and the idealized waveforms across this winding.



Over Voltage Protection

The Over Voltage Protection ensures that the output voltage will remain below an adjustable level. This works by sensing the auxiliary voltage via the current flowing into pin 4 (DEM) during the secondary stroke. This voltage is a well-defined replica of the output voltage. Any voltage spikes are averaged by an internal filter.
If the output voltage exceeds the OVP trip level, the OVP circuit switches the power MOSFET 'off'.
Next, the controller waits until the 'under voltage lock out' level (UVLO = ±9 V) is reached on pin 1 (VCC). This is followed by a safe restart cycle, after which switching starts again. This process is repeated as long as the OVP condition exists. The output voltage at which the OVP function trips, is set by the demagnetization resistor R3522.

Over Current Protection

The internal OCP protection circuit limits the 'sense' voltage
on pin 5 to an internal level.

Over Power Protection

During the primary stroke, the rectified AC input voltage is measured by sensing the current drawn from pin 4 (DEM). This current is dependent on the voltage on pin 9 of transformer 5520 and the value of R3522. The current information is used to adjust the peak drain current, which is measured via pin ISENSE.

Short Winding Protection

If the 'sense' voltage on pin 5 exceeds the short winding protection voltage (0.75 V), the converter will stop switching. Once VCC drops below the UVLO level, capacitor C2521 will be recharged and the supply will start again. This cycle will be repeated until the short circuit is removed (safe restart mode). The short winding protection will also protect in case of a secondary diode short circuit. This protection circuit is activated after the leading edge blanking time (LEB).

LEB time

The LEB (Leading Edge Blanking) time is an internally fixed delay, preventing false triggering of the comparator due to current spikes. This delay determines the minimum 'on' time of the controller.

Over Temperature protection

When the junction temperature exceeds the thermal shutdown temperature (typ. 140º C), the IC will disable the driver. When the VCC voltage drops to UVLO, the VCC capacitor will be recharged to the V(start) level. If the temperature is still too high, the VCC voltage will drop again to the UVLO level (Safe-Restart mode). This mode will persist until the junction temperature drops 8 degrees typically below the shutdown temperature.

Mains dependent operation enabling level

To prevent the supply from starting at a low input voltage, which could cause audible noise, a mains detection is implemented (Mlevel). This detection is provided via pin 8, that detects the minimum start-up voltage between 60 and 100 V. As previous mentioned, the controller is enabled between 60 and 100 V.
An additional advantage of this function is the protection against a disconnected buffer capacitor (CIN). In this case, the supply will not be able to start-up because the VCC capacitor will not be charged to the start-up voltage.

Control

Introduction

The microprocessor part of the UOC, has the complete control and teletext on board. User menu, Service Default Mode, Service Alignment Mode and Customer Service Mode are generated by the µP. Communication to other ICs is done via the I^2C-bus.

I 2 C-Bus

The main control system, which consists of the microprocessor part of the UOC (7200), is linked to the external devices (tuner, NVM, MSP, etc) by means of the I^2C- bus. An internal I^2C-bus is used to control other signal processing functions, like video processing, sound IF, vision IF, synchronization, etc.

User Interface

The L8/M8 uses a remote control with RC5 protocol. The incoming signal is connected to pin 67 of the UOC. The 'Top Control' keyboard, connected to UOC pin 80, can also control the set. Button recognition is done via a voltage divider.
The front LED (6691) is connected to an output control line of the microprocessor (pin 5). It is activated to provide the user information about whether or not the set is working correctly (e.g., responding to the remote control, normal operation (USA only) or fault condition).

In- And Output Selection

For the control of the input and output selections, there are three lines:

- **STATUS1** This signal provides information to the microprocessor on whether a video signal is available on the SCART1 AV input and output port (only for Europe). This signal is not connected in NAFTA sets.
- **STATUS2** This signal provides information to the microprocessor on whether a video signal is available on the SCART2 AV input and output port (only for Europe). For sets with an SVHS input it provides the additional information if a Y/C or CVBS source is present. The presence of an external Y/C source makes this line 'high' while a CVBS source makes the line 'low'.
- **SEL-MAIN-FRNT-RR** This is the source select control signal from the microprocessor. This control line is under user control or can be activated by the other two control lines.

Power Supply Control

The microprocessor part is supplied with 3.3 V and 3.9 V both derived from the 'MainAux' voltage via a 3V3 stabilizer (7560) and a diode.
Two signals are used to control the power supply:

- **Stdby_con** This signal is generated by the microprocessor when over-current takes place at the 'MainAux' line. This is done to enable the power supply into standby burst mode, and to enable this mode during a protection. This signal is 'low' under normal operation conditions and goes to 'high' (3.3 V) under 'standby' and 'fault' conditions.
- **POWER_DOWN** This signal is generated by the power supply. Under normal operating conditions this signal is 'high' (3.3 V). During 'standby' mode, this signal is a pulse train of approx. 10 Hz and a 'high' duration of 5 ms. It is used to give information to the UOC about the fault condition in the Audio amplifier supply circuit. This information is generated by sensing the current on the 'MainAux' line (using voltage drop across R3564 to trigger Q7562). This signal goes 'low' when the DC-current on the 'MainAux' line exceeds 1.6 - 2.0 A. It is also used to give an early warning to the UOC about a power failure. Then the information is used to mute the sound amplifier to prevent a switch off noise and to solve the switch-off spot.

Protection Events

Several protection events are controlled by the UOC:

- **BC protection**, to protect the picture tube from a too high beam current. The UOC has the capability of measuring the normal back level current during the vertical flyback. So if for some reason the CRT circuit is malfunctioning (i.e. high beam current), the normal black current will be out of the 75 µA range, and the UOC will trigger the power supply to shut down. However, this is a high beam-current situation, the TV screen will be bright white before the set is shut down.
- **E/W protection**, two protection mechanisms are built in, over-current and over-voltage.
  - In case of over-current due to defective parts in the line deflection output stage, a high current will flow through resistors 3405//3406. If this current is large enough to create a voltage drop of 0.7 V across 3405//3406, transistor Q7606 (in A7 diagram) will conduct and pin 80 of the UOC will be pulled down. Thereafter, the UOC will shut down the power supply. In case of further current increase, the fused resistor 3411 is built-in for double protection.
  - In case of a high voltage appearing across capacitor 2401 (dependent of the tube size), which is high enough to trigger zener diode 6401 into conduction, transistor Q7606 (in A7 diagram) will conduct and UOC is triggered to shut down the power supply.
- **I^2C protection**, to check whether all I^2C IC's are functioning.

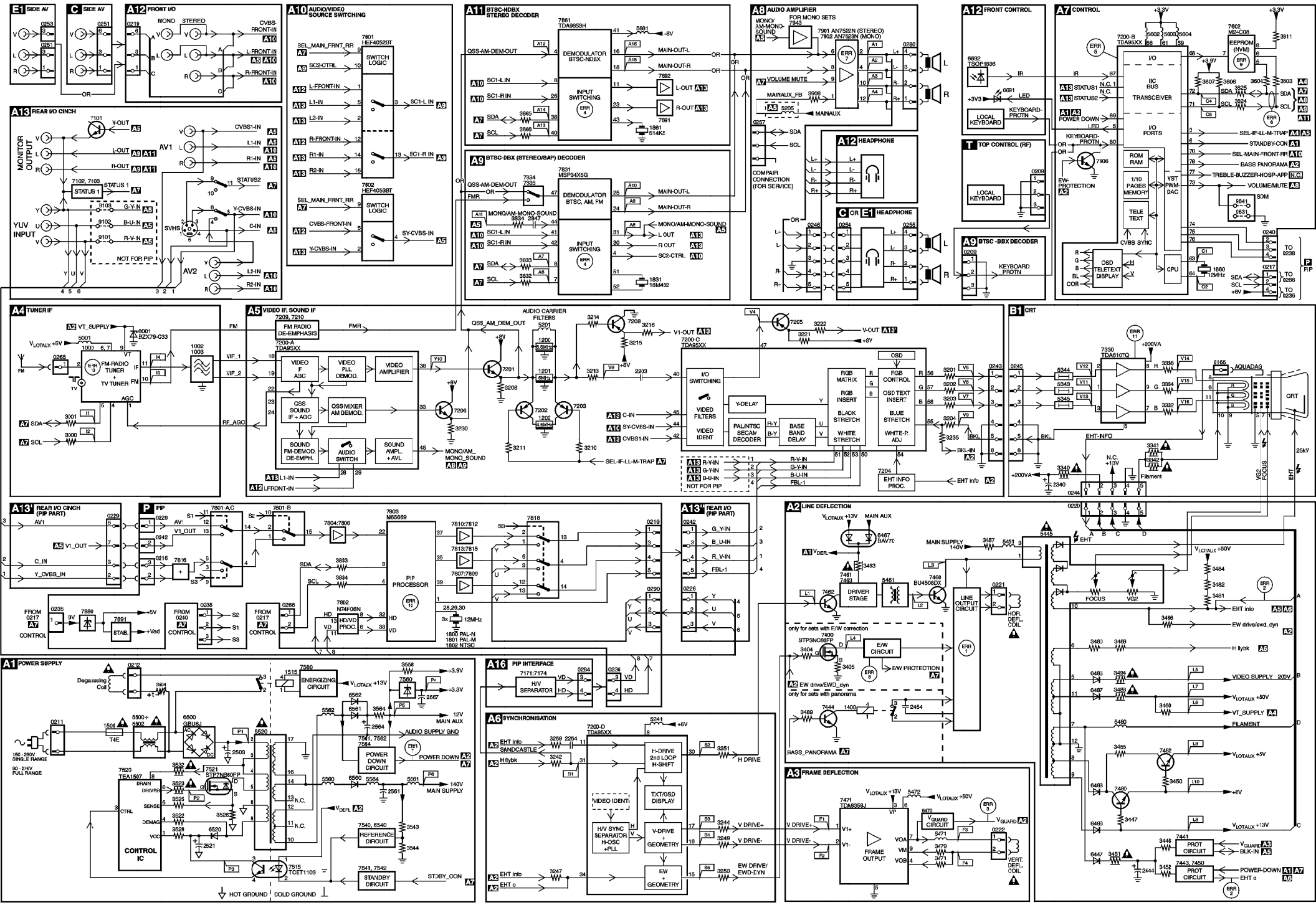
In case one of these protections is activated, the set will go into 'standby'.

The 'on' and 'standby' LEDs are controlled via the UOC.

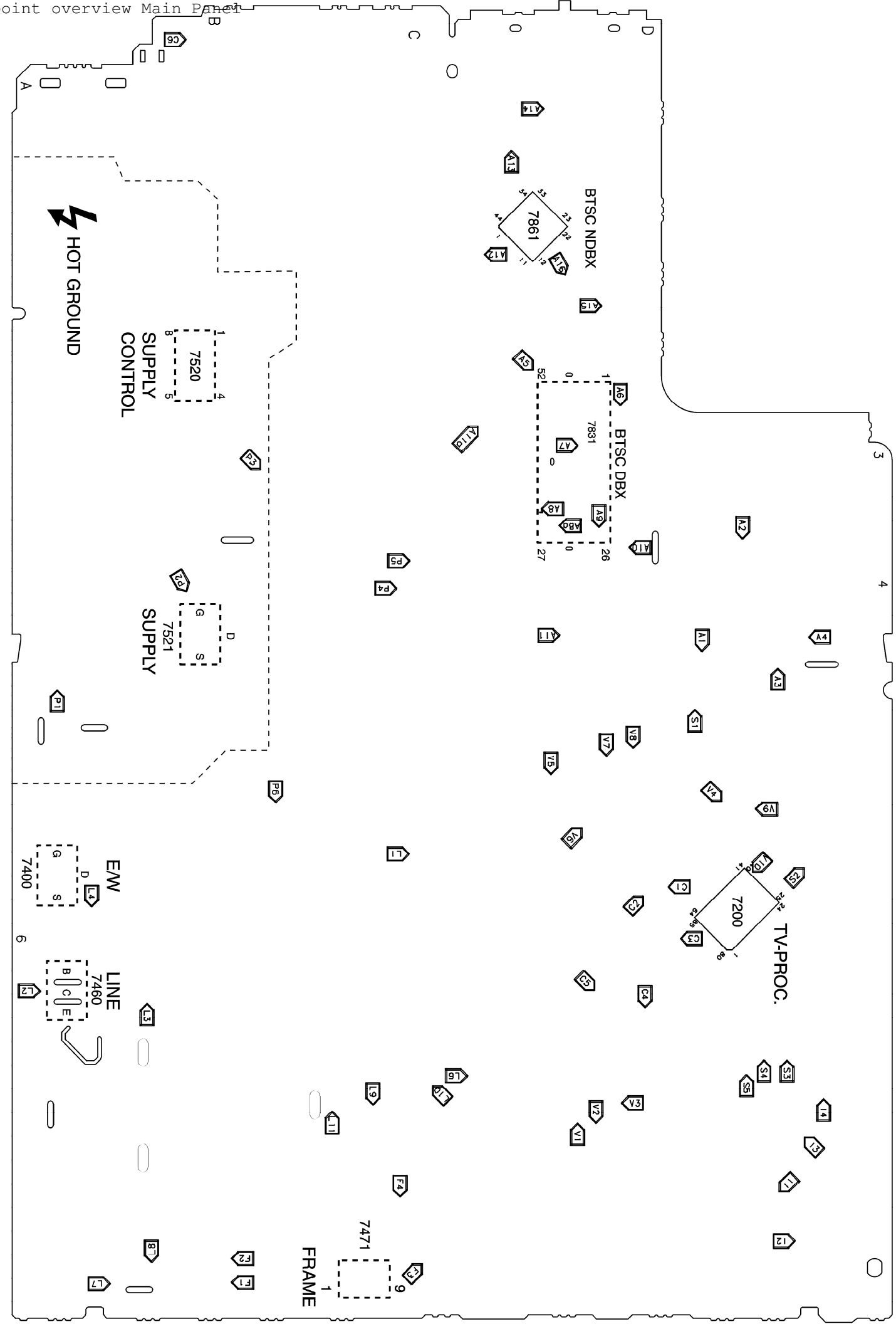
SCHEDMATIC BLOCK BY BLOCK CIRCUIT DESCRIPTION

POWER SUPPLY PAGE 1

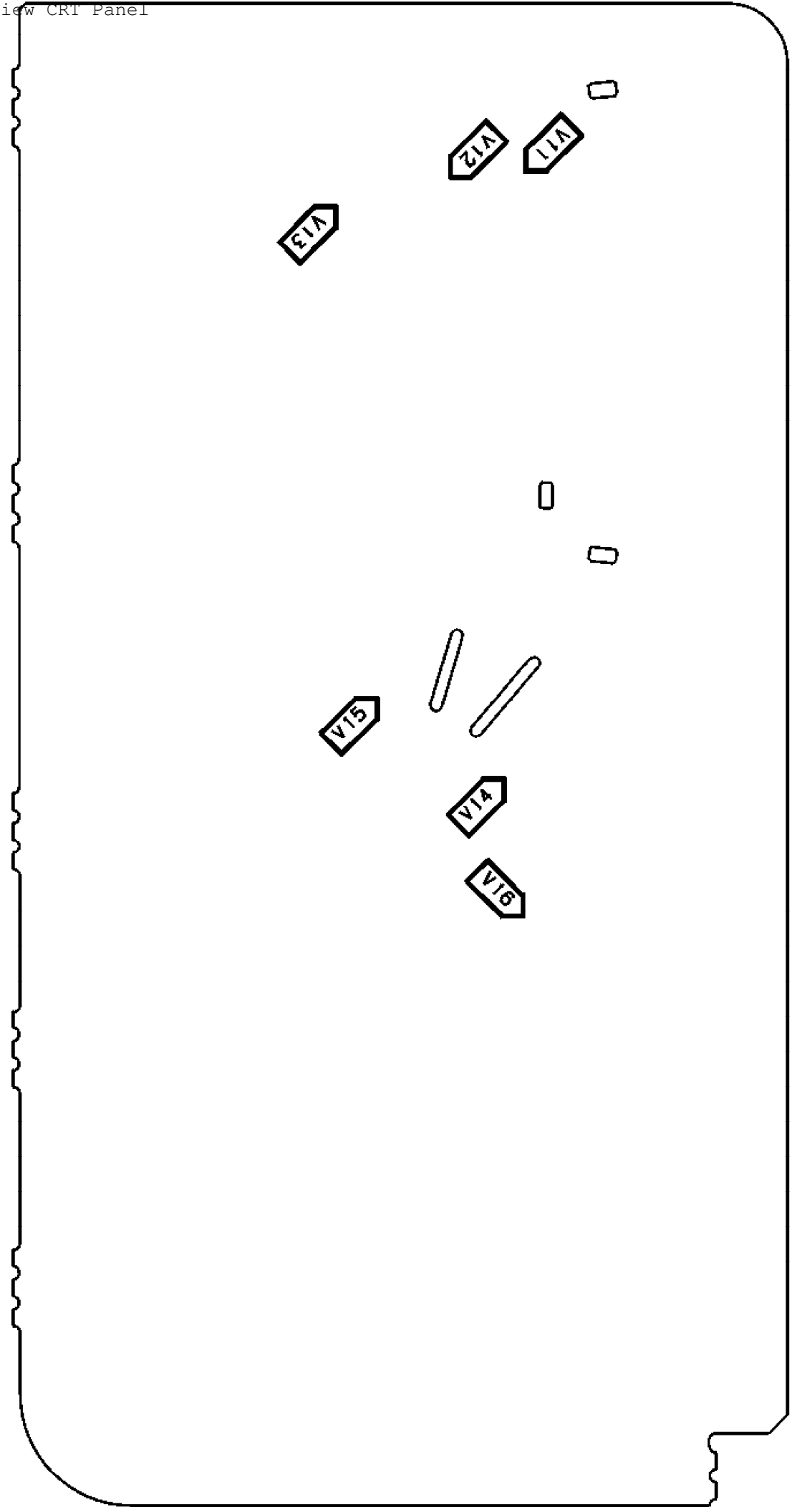
POWER SUPPLY PAGE 2

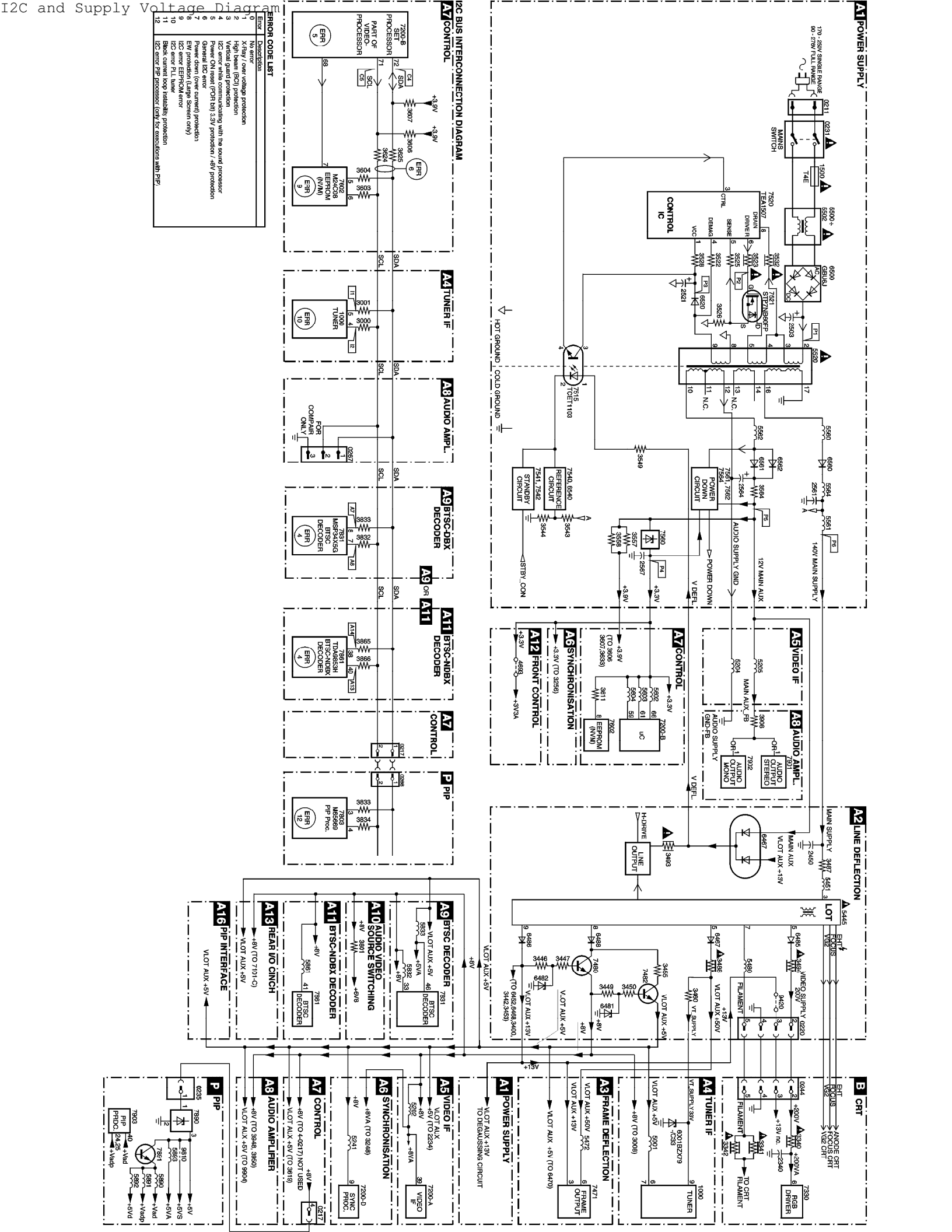

E1 SIDE AV
C SIDE AV
A12 FRONT I/O
A10 AUDIO/VIDEO SOURCE SWITCHING
A11 BTSC-NDBX STEREO DECODER
A8 AUDIO AMPLIFIER
A12 FRONT CONTROL
A7 CONTROL
A13 REAR I/O CINCH
A9 BTSC-DBX (STEREO/SAP) DECODER
A12 HEADPHONE
C OR E1 HEADPHONE
T TOP CONTROL (RF)
A9 BTSC -BBX DECODER
A4 TUNER IF
A5 VIDEO IF, SOUND IF
B1 CRT
A13 REAR I/O CINCH (PIP PART)
P PIP
A13 REAR I/O (PIP PART)
A2 LINE DEFLECTION
A1 POWER SUPPLY
A16 PIP INTERFACE
A6 SYNCHRONISATION
A3 FRAME DEFLECTION
Block

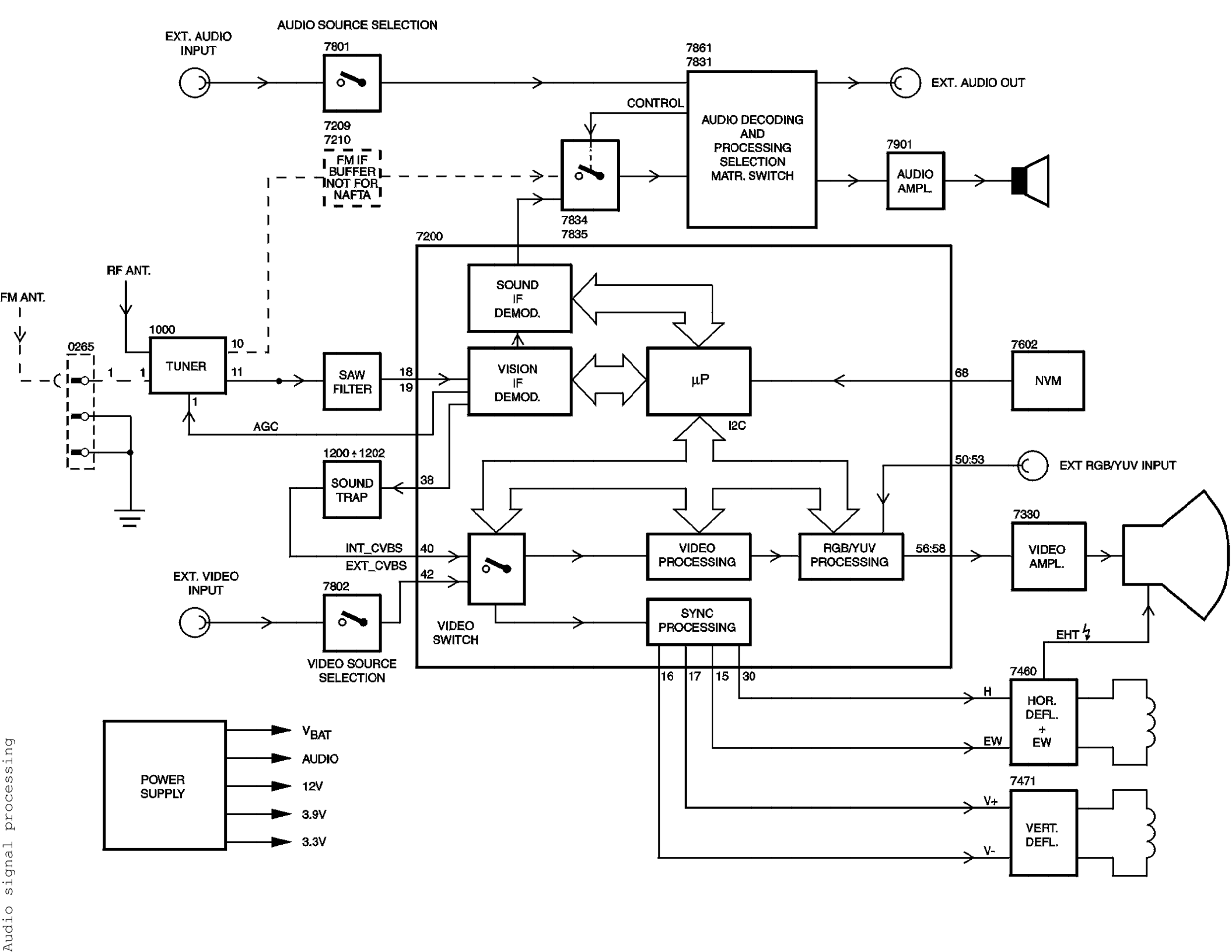
Test point overview Main Panel



Test point overview CRT Panel




A1 POWER SUPPLY
170 - 255V SINGLE RANGE
90 - 276V FULL RANGE
MAINS SWITCH
CONTROL IC
TEA1507
STF7NB60FP
TCET1103
POWER DOWN CIRCUIT
STANDBY CIRCUIT
REFERENCE CIRCUIT
HOT GROUND
COLD GROUND
140V MAIN SUPPLY
12V MAIN AUX
AUDIO SUPPLY GND
POWER DOWN
V DEFL
STBY_CON
A2 LINE DEFLECTION
LINE OUTPUT
LOT
H-DRIVE
MAIN SUPPLY
MAIN AUX
VLOT AUX +13V
VIDEO SUPPLY 200V
FILAMENT
VT SUPPLY
VLOT AUX +50V
VLOT AUX +13V
VLOT AUX +5V
VLOT AUX +8V
A3 FRAME DEFLECTION
FRAME OUTPUT
A4 TUNER IF
TUNER
TO CRT FILAMENT
A5 VIDEO IF
MAIN AUX_FB
AUDIO SUPPLY GND-FB
A6 SYNCHRONISATION
+3.3V (TO 3256)
A7 CONTROL
EEPROM (NVM)
A8 AUDIO AMPL.
AUDIO OUTPUT STEREO
AUDIO OUTPUT MONO
A9 BTSC-DBX DECODER
A10 AUDIO VIDEO SOURCE SWITCHING
A11 BTSC-NDBX DECODER
A12 FRONT CONTROL
A13 REAR I/O CINCH
A16 PIP INTERFACE
P PIP
PIP PROC.
B CRT
ANODE CRT
FOCUS CRT
RGB DRIVER
TO CRT FILAMENT
I2C BUS INTERCONNECTION DIAGRAM
PART OF VIDEO-PROCESSOR
SET PROCESSOR
MEMORY EEPROM (NVM)
TUNER
AUDIO AMPL.
MSP34XXG BTSC DECODER
TDA9855H BTSC-NDBX DECODER
PIP Proc.
SYNC PROC.
ERROR CODE LIST
Error
Description
0 No error
1 X-Ray / over voltage protection
2 High beam (BCI) protection
3 Vertical guard protection
4 I2C error while communicating with the sound processor
5 Power ON reset (POR bit) 3.3V protection / 8V protection
6 General I2C reset
7 Power down (over current) protection
8 EW protection (Large Screen only)
9 I2C error EEPROM error
10 I2C error PLL tuner
11 Black current loop instability protection
12 I2C error PIP processor (only for executions with PIP)



Audio signal processing

Mono set

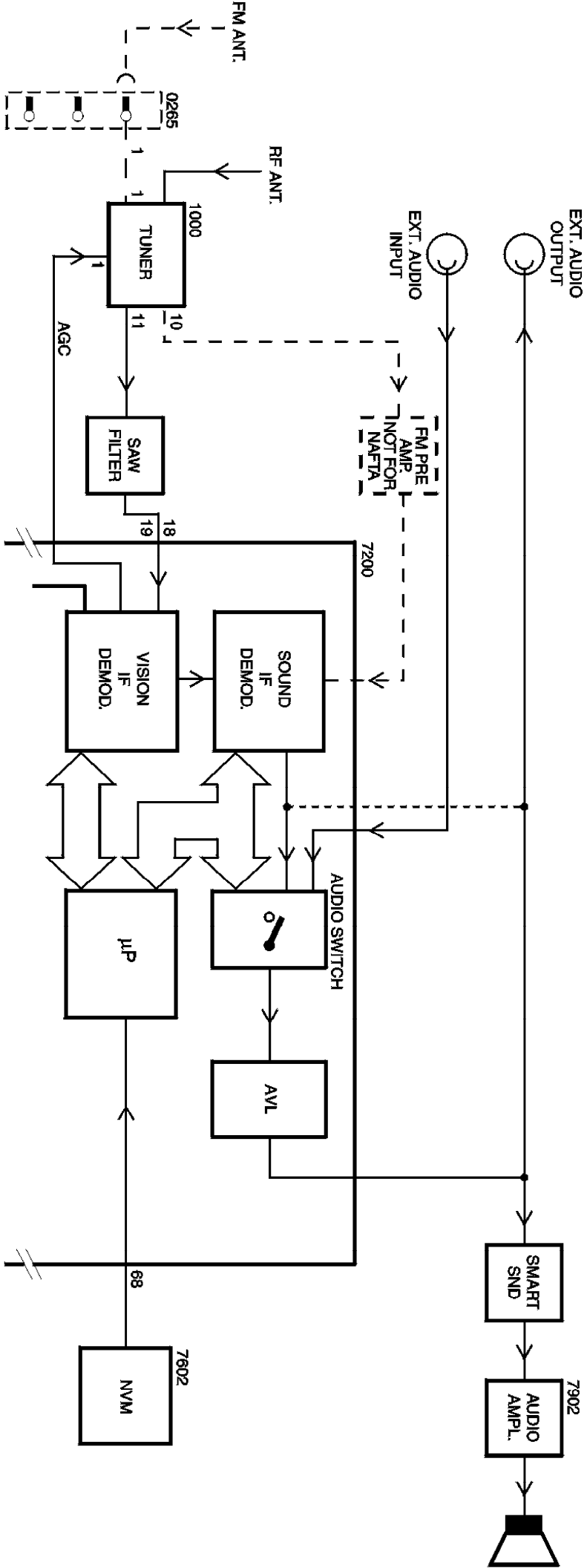

FM ANT.
0265
1
RF ANT.
1
TUNER
1000
1
AGC
11
10
SAW FILTER
19
18
7200
EXT. AUDIO INPUT
EXT. AUDIO OUTPUT
FM PRE AMP. NOT FOR NAFTA
VISION IF DEMOD.
SOUND IF DEMOD.
µP
AUDIO SWITCH
AVL
68
NVM
7602
SMART SND
AUDIO AMPL.
7902

Figure 1

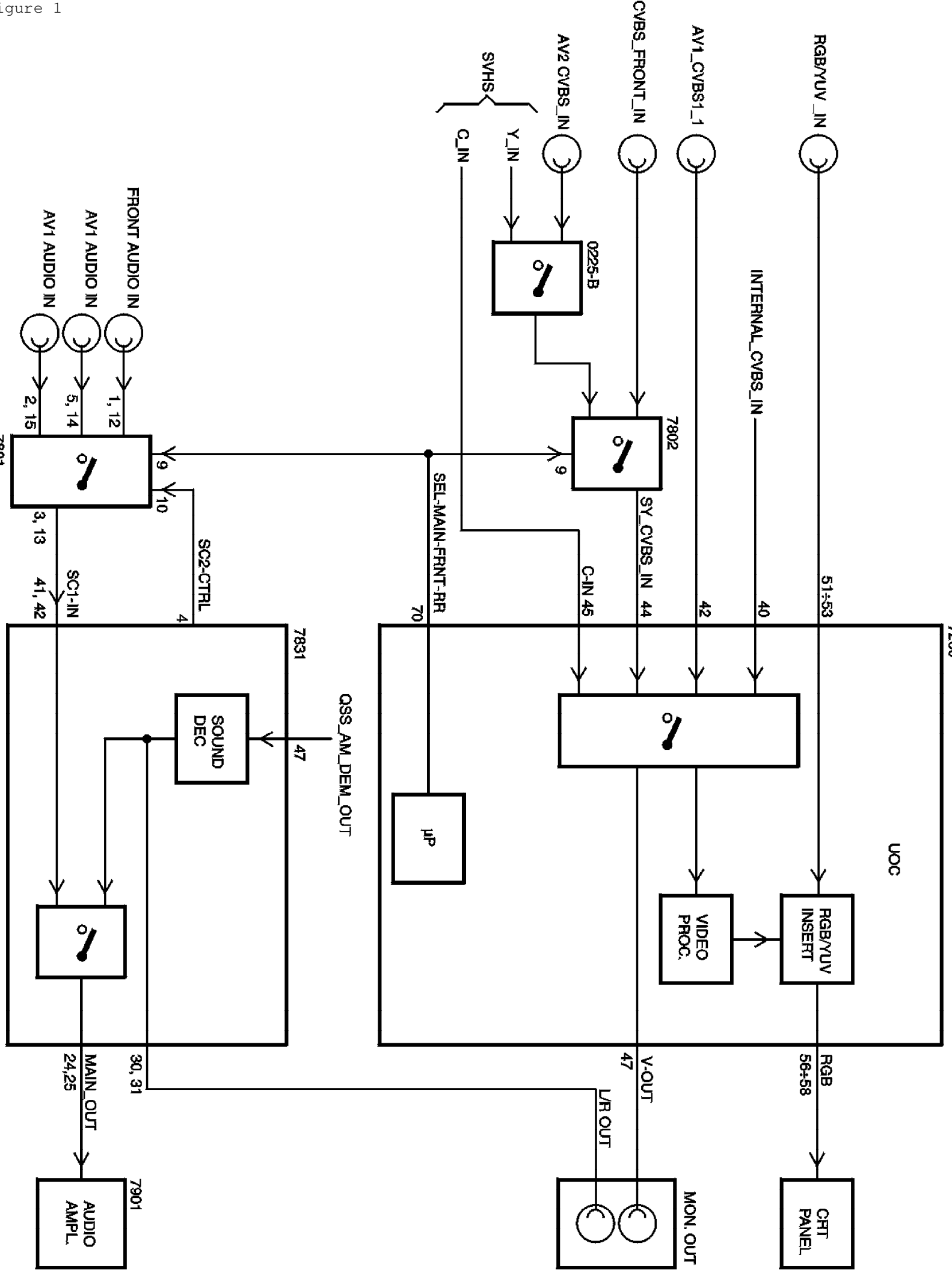

RGB/YUV_IN
AV1_CVBS1_1
CVBS_FRONT_IN
AV2 CVBS_IN
SVHS
Y_IN
C_IN
0225-B
INTERNAL_CVBS_IN
7802
SY_CVBS_IN 44
C-IN 45
SEL-MAIN-FRNT-RR
70
51÷53
42
40
7200
UOC
RGB/YUV INSERT
VIDEO PROC.
µP
RGB 56÷58
CRT PANEL
V-OUT 47
L/R OUT
MON. OUT
FRONT AUDIO IN
AV1 AUDIO IN
AV1 AUDIO IN
2, 15
5, 14
1, 12
7801
9
10
3, 13
41, 42
SC1-IN
SC2-CTRL
4
7831
SOUND DEC
47
QSS_AM_DEM_OUT
30, 31
MAIN_OUT 24,25
AUDIO AMPL.
7901

Figure 1

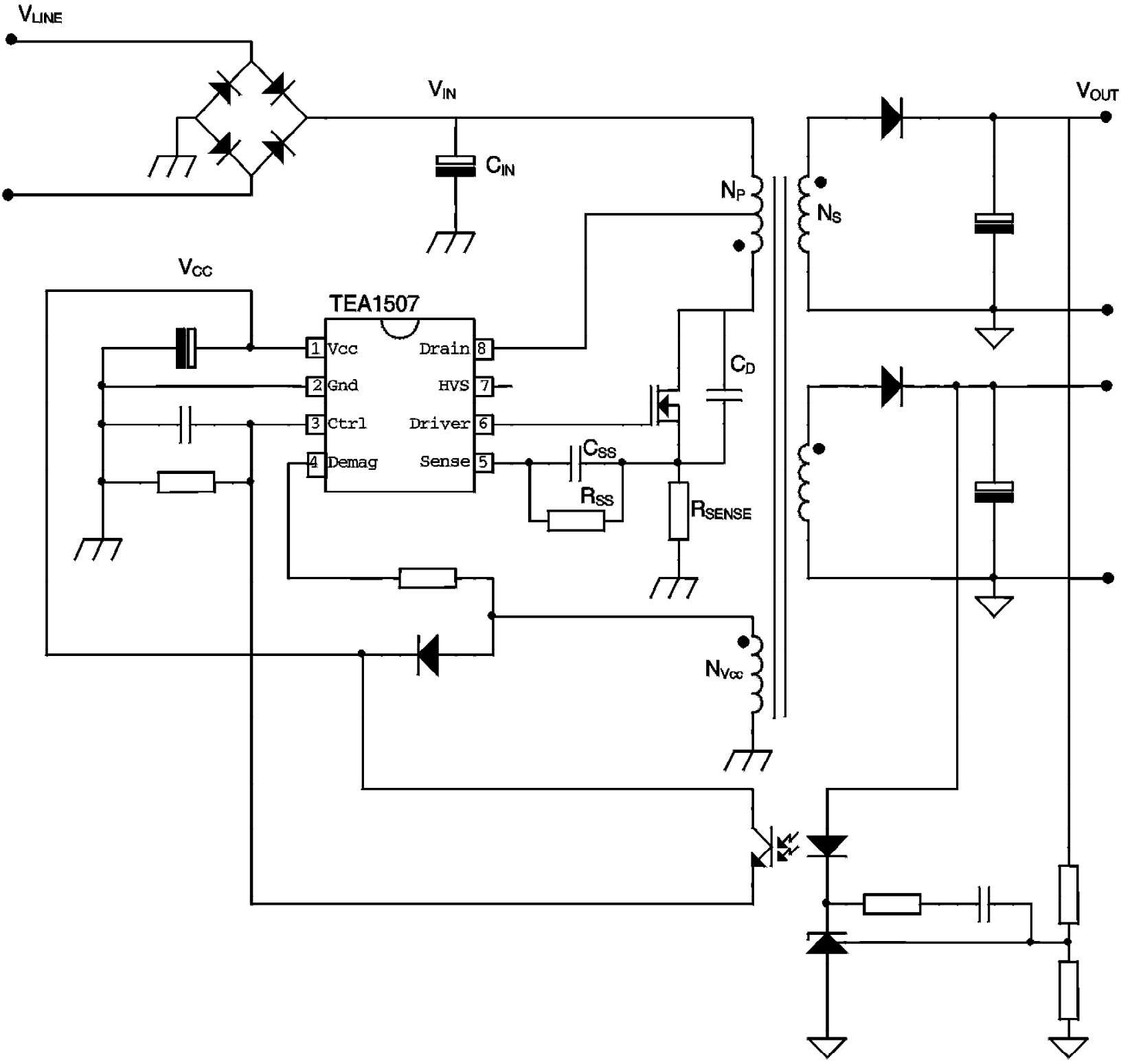

VLINE
VIN
CIN
VOUT
NP
NS
VCC
TEA1507
1 Vcc
2 Gnd
3 Ctrl
4 Demag
Drain 8
HVS 7
Driver 6
Sense 5
CD
CSS
RSS
RSENSE
NVcc

Figure 2

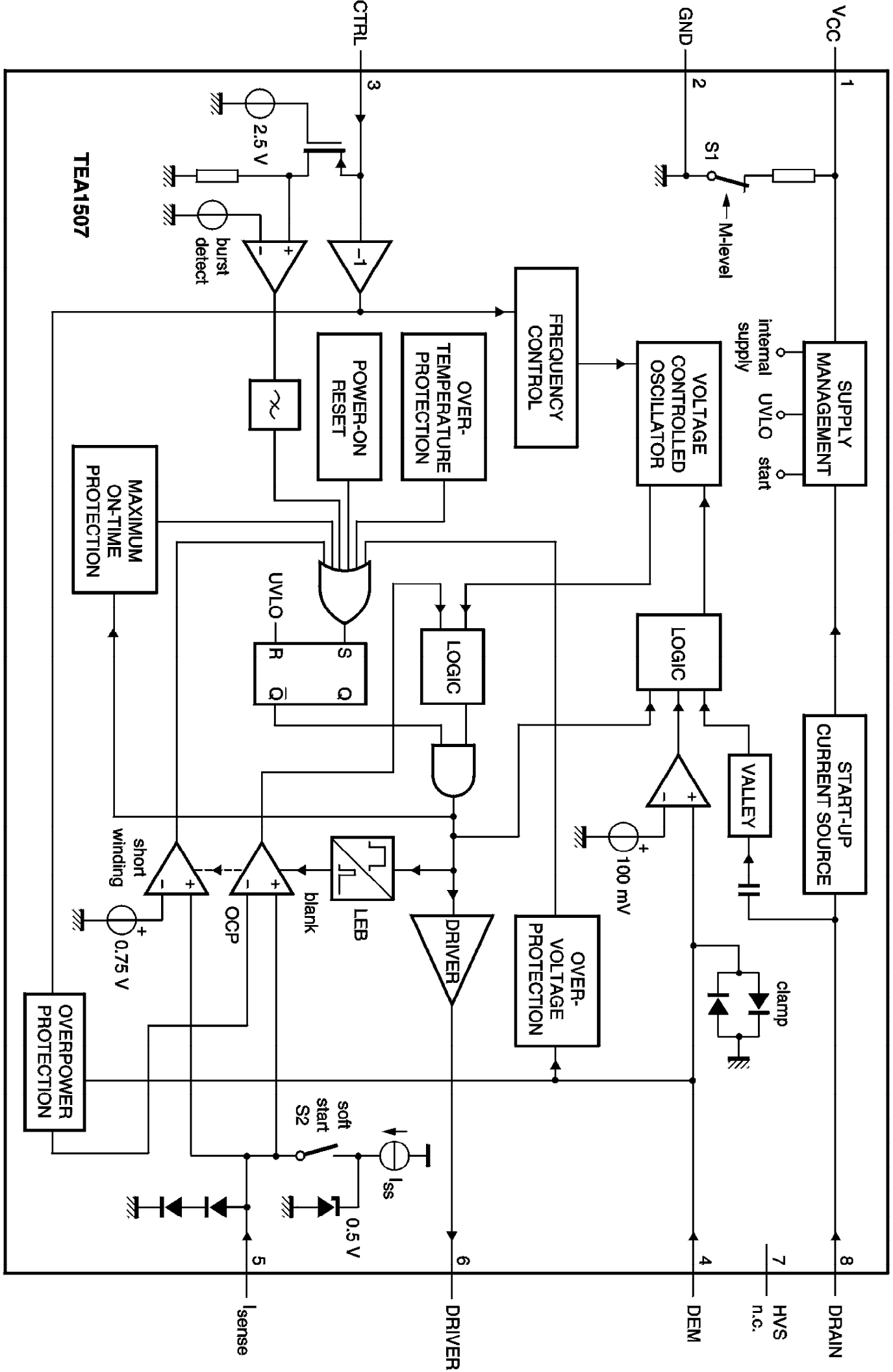
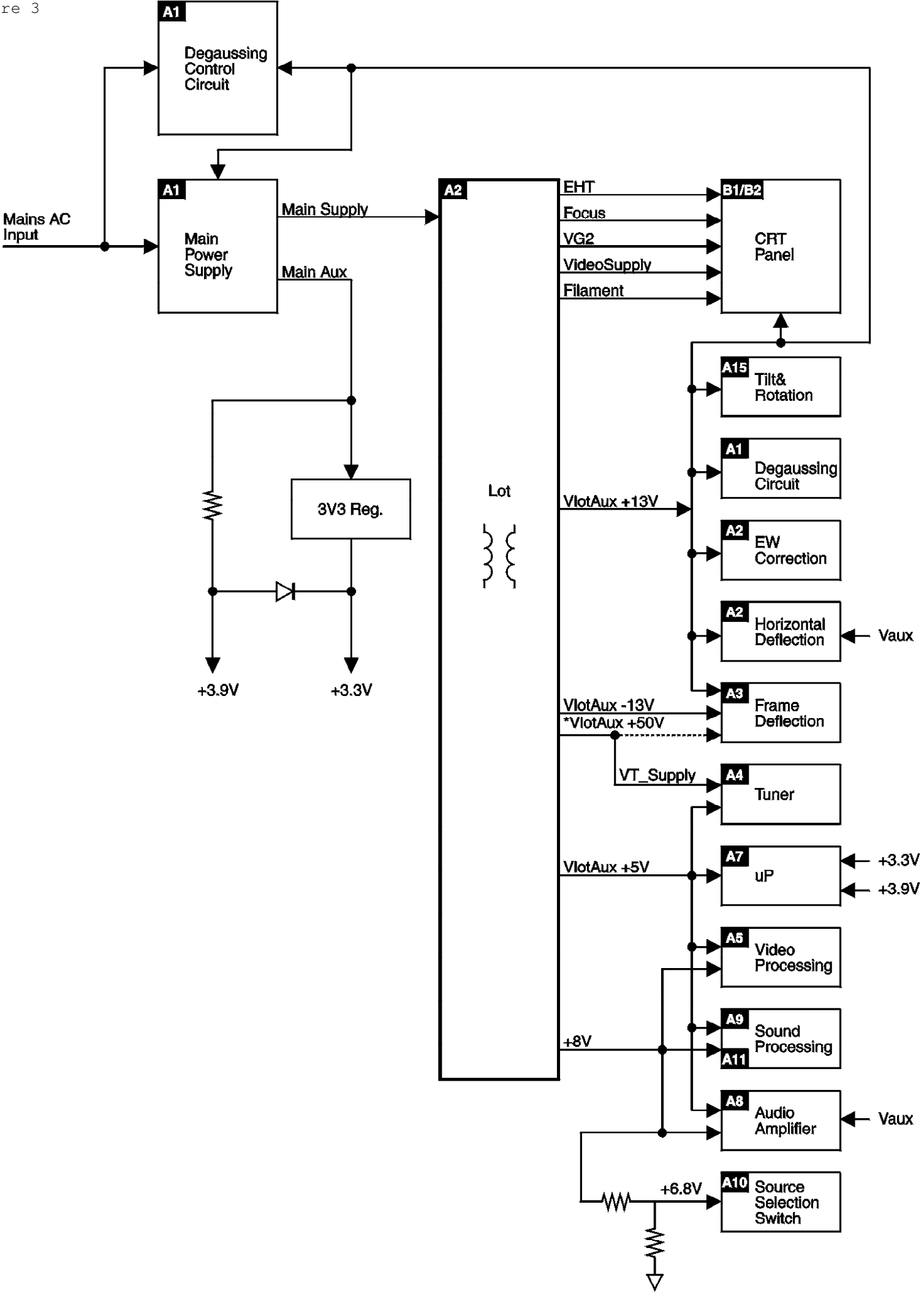
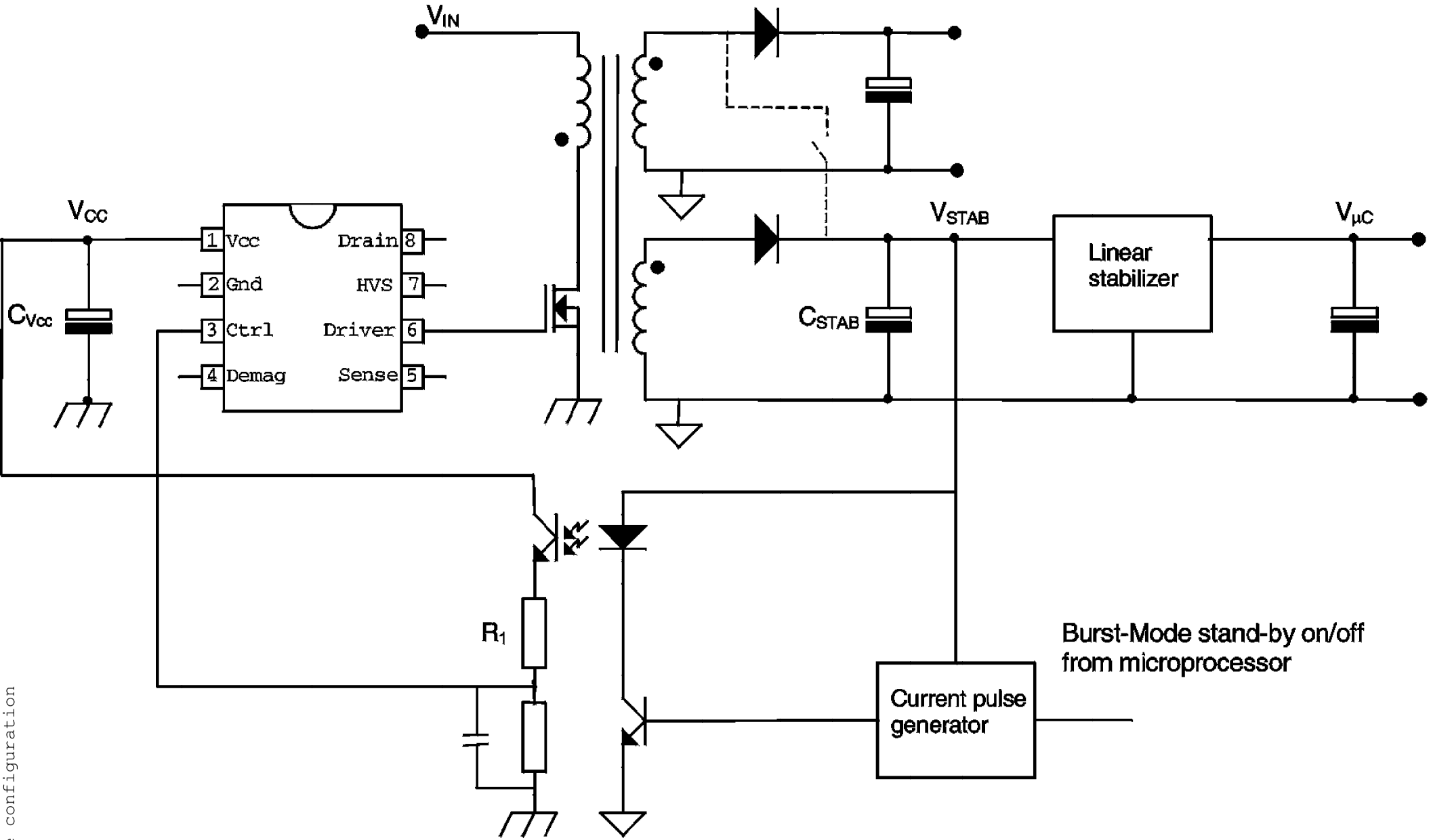

TEA1507
VCC
GND
CTRL
DRAIN
DEM
HVS
n.c.
DRIVER
Isense
1
2
3
4
5
6
7
8
SUPPLY MANAGEMENT
internal
UVLO
start
supply
VOLTAGE CONTROLLED OSCILLATOR
FREQUENCY CONTROL
OVER-TEMPERATURE PROTECTION
POWER-ON RESET
MAXIMUM ON-TIME PROTECTION
UVLO
R
S
Q
LOGIC
LOGIC
START-UP CURRENT SOURCE
VALLEY
100 mV
clamp
OVER-VOLTAGE PROTECTION
DRIVER
LEB
blank
OCP
short winding
0.75 V
OVERPOWER PROTECTION
soft start
S2
Iss
0.5 V
S1
M-level
2.5 V
burst detect
-1

Figure 3

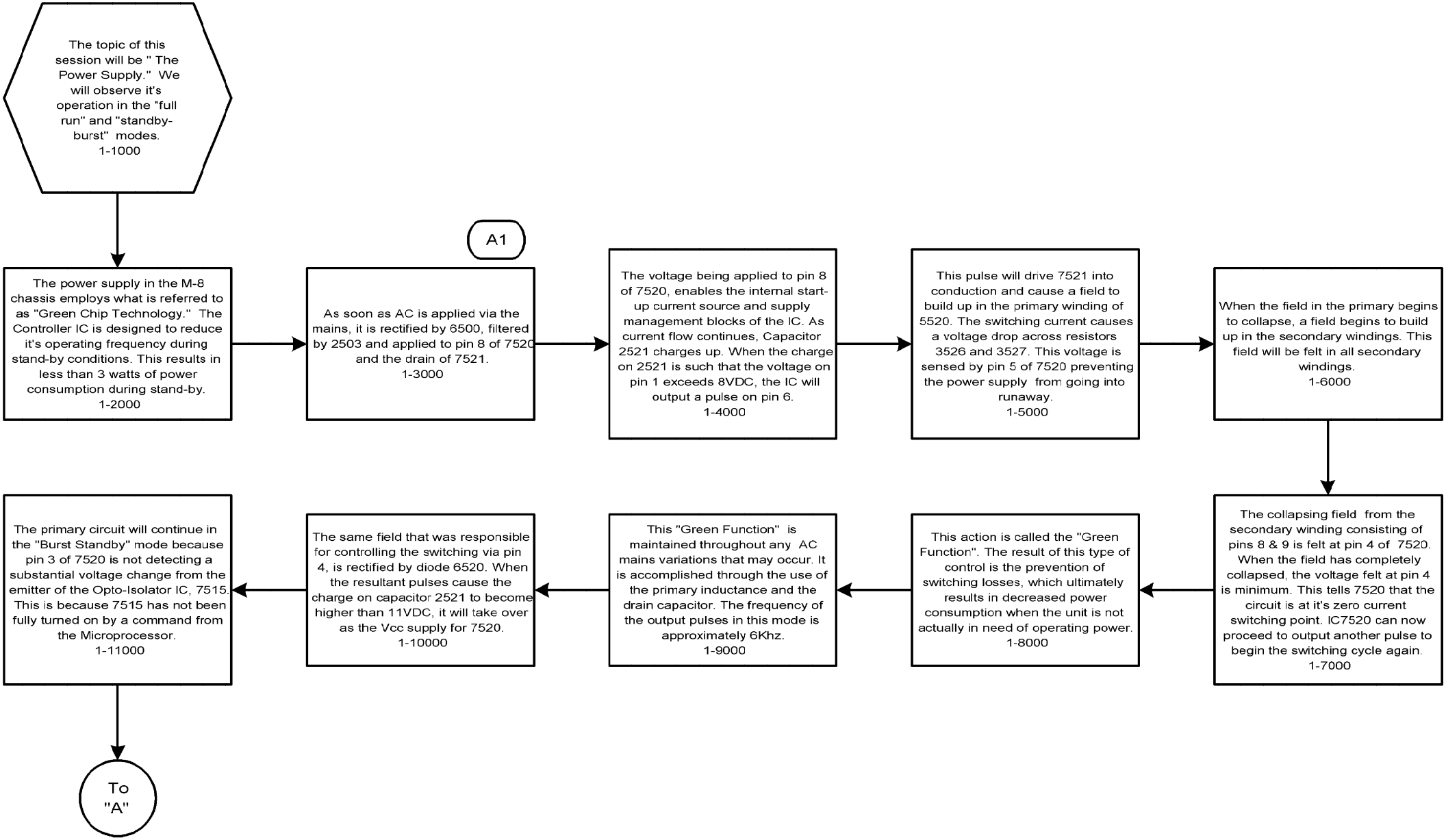

A1
Degaussing Control Circuit
A1
Main Power Supply
Mains AC Input
Main Supply
Main Aux
3V3 Reg.
+3.9V
+3.3V
A2
Lot
EHT
Focus
VG2
VideoSupply
Filament
B1/B2
CRT Panel
VlotAux +13V
VlotAux -13V
*VlotAux +50V
VT_Supply
VlotAux +5V
+8V
A15
Tilt& Rotation
A1
Degaussing Circuit
A2
EW Correction
A2
Horizontal Deflection
Vaux
A3
Frame Deflection
A4
Tuner
A7
uP
+3.3V
+3.9V
A5
Video Processing
A9
A11
Sound Processing
A8
Audio Amplifier
Vaux
+6.8V
A10
Source Selection Switch



Basic Burst mode configuration

Basic Burst mode configuration

M-8
Generic Training
Power Supply 1



Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Power Supply 2

"A"

A1

At this point in time, our power supply is sitting in the "Standby" mode waiting for a command from the microprocessor to enter the "Full-Run" mode.
1-12000

Voltages are present on the secondary source points. However, they are at 80% or less of rated run voltages. The only exceptions to this are the 3.9V and 3.3V sources. They are very close to full run levels.
1-13000

Transistor 7542 is monitoring the pulses (bursting) coming from pin 10 of 5520. The average DC voltage derived from the pulses provides a bias for 7542. The peak voltages provide sufficient amplitude to pulse the transistor on and off which, in turn, are sufficient to turn 7541 on and off (at a very low level).
1-14000

The positive going pulses on the base of 7541 are inverted into negative going pulses on it's collector. These pulses are barely enough in peak amplitude to cause the diode portion of 7515 to conduct slightly. This allows the transistor portion to send low level pulses along with a very low level average DC voltage to pin 3 of 7520. The internal burst detector senses that we are in a burst standby mode and that the voltage is too low to affect the input control circuit.
1-15000

A7

When the "Power-On" command is received from either the front panel or the IR receiver, pin 6 of the microprocessor, 7200, is internally pulled low.
1-16000

A1

This action effectively grounds the cathode of 6566, clamping the base of 7541 to .6 volts. This causes a momentary halt to the pulsing that is being sent to pin 3 of 7520. The power supply is now out of the "Burst Mode".
1-17000

When this occurs, the internal frequency control in 7520 calls for an increase in frequency to try to return to the burst mode of operation. Because 7541 has effectively been clamped OFF, the frequency will continue to increase until "Full Power" has been achieved.
1-18000

Once the secondary voltages reach their full potential, transistor 7540 assumes control of the conduction of the regulator IC, 7515, by monitoring the 140V Supply.
1-19000

IC 7515 is now conducting within it's full range and the voltage on pin 3 of 7520 is a steady 1.3 volts. This voltage will only vary slightly as corrections become necessary for precise regulation.
1-20000

A7-A1

If a fault should occur (during full-run conditions) in the power supply or a heavy load appear on one of the secondary supplies, transistor 7561 will be turned ON which will bring pin 69 of 7200 LOW causing the microprocessor to shut down. This will bring the power supply back to the "Burst" mode.
1-21000 & 1-22000

If a short occurs on the 140 volt line, transistor 7540 will turn OFF, which will also bring the power supply into the "Burst" mode.
1-23000

We have just completed our overview on the Power Supply.
1-24000

Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Video Paths 1

The topic of this session will be "Video Paths", Internal (tuner), External and PIP.

1-1000

A4

RF signals are input to the unit at the antenna isolator. The isolator provides safety isolation from the "Hot Chassis." From the isolator, the signals are sent to the U/V Tuner where the RF is amplified, sent to the internal IF circuits, processed and output on pin 11.
1-2000

A12

Channel selection is performed by a customer keyboard or a remote receiver.
1-3000

A4

From pin 11 of the U/V tuner, the IF signal is sent through the SAW filter, 1002 where it is shaped prior to exiting on pins 4 and 5.
1-4000

A5

From there, the signal is sent to pins 18 and 19 of 7200 where it is further amplified and processed.
1-5000

After processing, the composite video exits 7200 at pin 38 and is buffered by transistor 7201.
1-6000

At this time, in sets designed for Global Operation, pin 3 of 7200 is brought Low causing the trap selection line to go low which turns transistors 7202 and 7203 On. In sets designed for the US, those transistors and the trap are not in the circuit and the video is routed directly to 7200 pin 40 and the base of 7208.
1-7000

In Global sets our composite video will pass through the 4.5Mhz Audio Trap, 1202 where any Audio present is blocked and the Video continues through to pin 40 of 7200 and to the base of buffer transistor 7208.
1-8000

Once the signal returns to 7200, it passes through the I/O selection switch where it splits off in three directions. The Luminance is sent through a peaking and delay circuit and the R-Y and B-Y components are sent through video filters, video identification, the NTSC decoder and the baseband delay line where they all enter the RGB/YUV insert block as Y, U, & V signals. The un-altered video is sent out pin 47 to the rear Jack Panel as Video Out.
1-9000

A5 A13

A5

Also entering the RGB/YUV insert block at this time are four signals from the PIP module. They consist of PIP YUV and Fast Blanking and enter 7200 at pins 50 through 53.
1-10000

All signals are now matrixed in the insert block, sent to the OSD/TEXT insert block and exit 7200 at pins 56 through 58 as R, G and B drive signals. They are then applied to 0243 which is routed to the CRT board.
1-11000

B1

Entering the CRT board on pins 1, 2 and 3 of 0245, the drive signals are sent to pins 1, 2 and 3 of the Video Amplifier IC, 7330 where they are amplified and applied to the CRT via the CRT socket. Biasing and balance of the drive signals are accomplished by monitoring pin 5 of 7330 and feeding back the information to 7200 on what is called the "Black Current Line".
1-12000

A5

This feedback is in the form of current monitoring (during the vertical blanking interval) and enters 7200 on pin 55. The result, is correction of the drive signals within 7200. This information is also used to prevent any video drive signals from being output to the CRT board until proper CRT current has been verified.
1-13000

To "A"

Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Video Paths 2

"A"

A5

We have just examined the basic Tuner Video Path. Now, we will look at the PIP Video Path used when the Tuner Video is selected to be used as PIP.
1-14000

Looking back at the Video Buffer, 7201, we will now examine the second path that ourTuner video will take. From the Video Buffer to the base of 7208 where it is again buffered, then sent to the PIP circuitry.
1-15000

A13

The buffered video is sent to the Rear Jack Panel where it connects to pin 7 of connector 0229.
1-16000

P

From 0229, it is sent directly to pin 2 of 0242 on the PIP Module. If, at this time, it is chosen to become the PIP Video, it is switched by 7801 A & B and applied to the base of 7804 where it is again buffered and applied to the emitter of 7805. There, it is amplified, sent through buffer transistor 7806, and applied to 7803, pins 22 & 23.
1-17000

If the Tuner Video is meant to be the Main Video source, it will not be selected by 7801- A to be applied to 7803. Instead, our PIP will have to come from an external input.
1-18000

A13

Looking at the Rear Jack Panel, we will select the AV1 section for our external input. The path we are concerned with for Video chosen to become PIP is what we are looking at. However, before we go further into PIP we must become aware of the other path the video could take from AV1.
1-19000

Video enters 0223-B and immediately splits in two directions. The first path is through 3122 to.....
1-20000

A5

.....pin 42 of 7200. This path would be used if the External Video had been chosen to become our Main Video. (continued)
1-21000

A13

The path we are concerned with at this time is from 0223-B to pin 5 of 0229.
1-22000

P

From pin 5 of 0229 on the chassis, we enter pin 2 of 0229 on the PIP panel. From pin 2, our video enters pin 12 of the switching IC, 7801-A. At that point it is switched to output on pin 14 and from there it takes the same path we reviewed under Tuner Video (being used as PIP Video).
1-23000

Communications from the Microprocessor enter 7803 on pins 3 and 4. Vertical and Horizontal Sync pulses enter 7803 on pins 33 and 32.
1-24000

After processing, the outputs are in the form of Y, U, and V (RGB) waveforms and exit on pins 35, 37 and 39. They are then amplified by transistors 7807, 7810 and 7813.
1-25000

They are again amplified by transistors 7809, 7812 and 7815. From there they are switched through 7818 and applied to 0219 where they are joined by the Fast Blanking pulse from pin 1 of 7803.
1-26000

A13

From 0219, the four signals are sent to 0242 pins 5, 4, 3 and 1. At that point they are sent to.....
1-27000

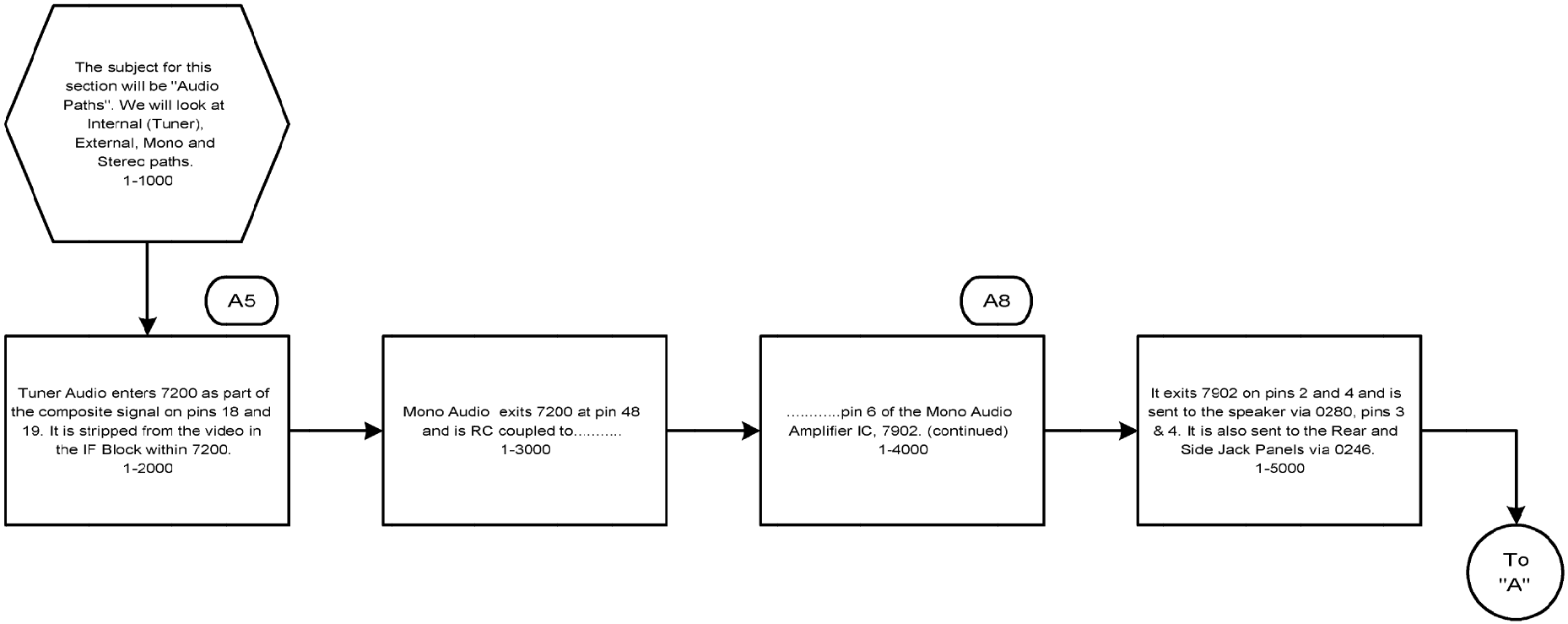
A5

..... 7200, pins 51, 52, 53 and 60 where they enter the insertion (mixing) block and are combined with the Main Video signal. From there, they enter the OSD/TXT insert block to be combined with any OSD or Closed Caption Text. They exit 7200 on pins 56, 57 and 58 as RGB Drive signals being applied to 0243 and from there to the CRT board. (continued)
1-28000

This completes our examination of the Video Signal Paths.
1-29000

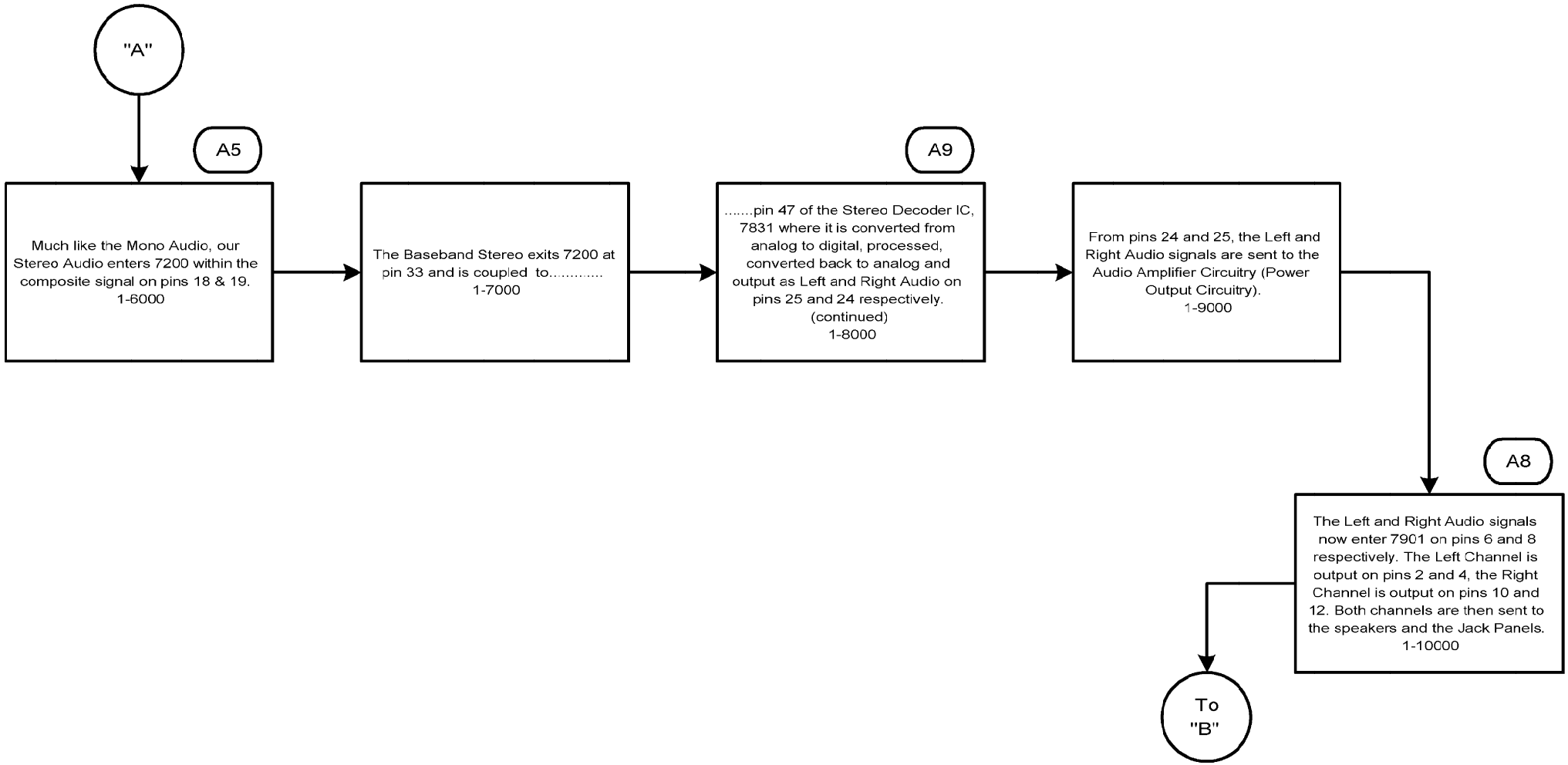
Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Audio Paths 1



Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Audio Paths 2



Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Audio Paths 3

"B"

For our External Audio Path we will use the Rear Jack Panel for our input device.
1-11000

A13

Our Left and Right Audio signals are input to the Rear Jack Panel at the AV1 section on pins 6 and 7 respectively, of 0223-B.
1-12000

If the External input is Mono, the Left Channel will be used for the input and will be sent to pin 28 of 7200.
1-13000

A5

It will enter 7200-C at pin 28 and will be switched in 7200-A (which is part of the I/O switch in 7200-C). From the switching network, it will be amplified and exit at pin 48. From there on, it will be processed the same as Mono Tuner Audio.
1-14000

A13

If the External input is Stereo, both channels will be sent to 7801 for switching (selection).
1-15000

A10

The Left channel will enter 7801 at pin 5 and the Right channel will enter on pin 14.
1-16000

7801 receives switching instructions on pins 9 and 10 from the Microprocessor portion of 7200 and pin 4 of 7831. Once 7801 has switched to accommodate the left and right channels, they will be output on pins 3 and 13 respectively.
1-17000

A9

From there, they are coupled to 7831, pins 41 and 42 respectively. Here they are converted from analog to digital, processed, amplified, converted back to analog and output on pins 25 and 24.
1-18000

A8

The Left and Right audio signals are now sent to the Audio Output IC, 7901 pins 6 and 8.
1-19000

Here each channel is amplified. They exit 7901 on pins 2 & 4 and 10 & 12.
1-20000

A7

Volume Control and Mute functions are performed by the Microprocessor in the form of PWM signals. These signals exit 7200 on pin 73, are converted to DC levels by 3818, 2604.....
1-21000

A8

.....3907 and 2908. The resultant DC levels are applied to pin 9 of 7902 (for Mono) or pin 9 of 7901 (for Stereo). (continued)
1-22000

Finally, Right and Left outputs are sent to the speakers via 0280, Side Jack Panel and Rear Jack Panel via 0246. Because we began our journey at the Rear Jack Panel, we will end it at the Side Jack Panel.
1-23000

E1

The Side Jack Panel consists of three inputs and two outputs. The outputs, being the ones we are concerned with, are the Headphone Jack and Connector 0255.
1-24000

Our Right and Left Audio are input on 0254, pins 1 & 2 and 4 & 5 respectively. When headphones are plugged in to 0232, pins 1 & 4 of 0255 are disabled and our audio will be sent through the headphones only. When no headphones are used, our audio will be routed to the speakers through 0255.
1-25000

We have just completed our examination of the Audio Signal Paths.
1-26000

Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Horizontal 1

In this section we will follow the Horizontal Path from the origination of the drive signal through High Voltage generation and development of scan derived supplies.
1-1000

A6

When the Power On command is received by the Microprocessor, the horizontal oscillator, internal to 7200, begins to output a frequency that is approximately twice that of a normal horizontal frequency. This is called a "Soft Start" condition. The Off time of the Horizontal Output transistor is Normal However, the On time is very short. It takes about 1175 mseconds for the On time to increase to normal horizontal frequency.
1-2000

This delay or slow rise time, is used to produce a slow rise in the EHT for picture tubes with Dynamic Astigmatic Focus (DAF) guns. When the normal frequency is reached, the PLL circuitry takes over, insuring only minor corrections will be necessary.
1-3000

The horizontal drive signal exits 7200 on pin 30.
1-4000

A2

From pin 30 it is sent.....
1-5000

.....to the base of 7462, the Horizontal Driver transistor where it is amplified and directly coupled to the base of 7461 & 7463. These two transistors are hooked in push-pull for maximum efficiency and provide a precise output to drive transformer 5461.
1-6000

The field that is built up on the primary, is coupled to the secondary to drive the Horizontal Output transistor, 7460. The signal is amplified by 7460, shaped by 5452, 2463, 2465 and sent to the Horizontal Deflection Yoke and Flyback Transformer.
1-7000

The Flyback Transformer (5445) produces several secondary voltages, normally referred to as "Scan Derived".
1-8000

The first Scan Derived voltages we will observe are the ones that are sent to the CRT or the CRT Board. They are the High Voltage (EHT), Focus Voltage, Screen Voltage (VG2), Filament Voltage and the 200 volt supply (Video Supply).
1-9000

A2, A3,A4

The next two supplies are the VT_Supply which is ultimately zenered down to 33 volts and fed to the Tuner and the +50V supply that feeds the Vertical Output Stage.
1-10000, 1-11000 & 1-12000

A2

The VlotAux +13V supply is sent to many areas on the chassis. However, there are two scan derived voltages that are dependant on this supply to energize; The +8V and the VlotAux +5V supplies.
1-13000

When the VlotAux +13V supply comes up, the base of 7480 goes High which energizes the +8V supply. When that occurs, the base of 7482 goes High, energizing the VlotAux+5V supply.
1-14000

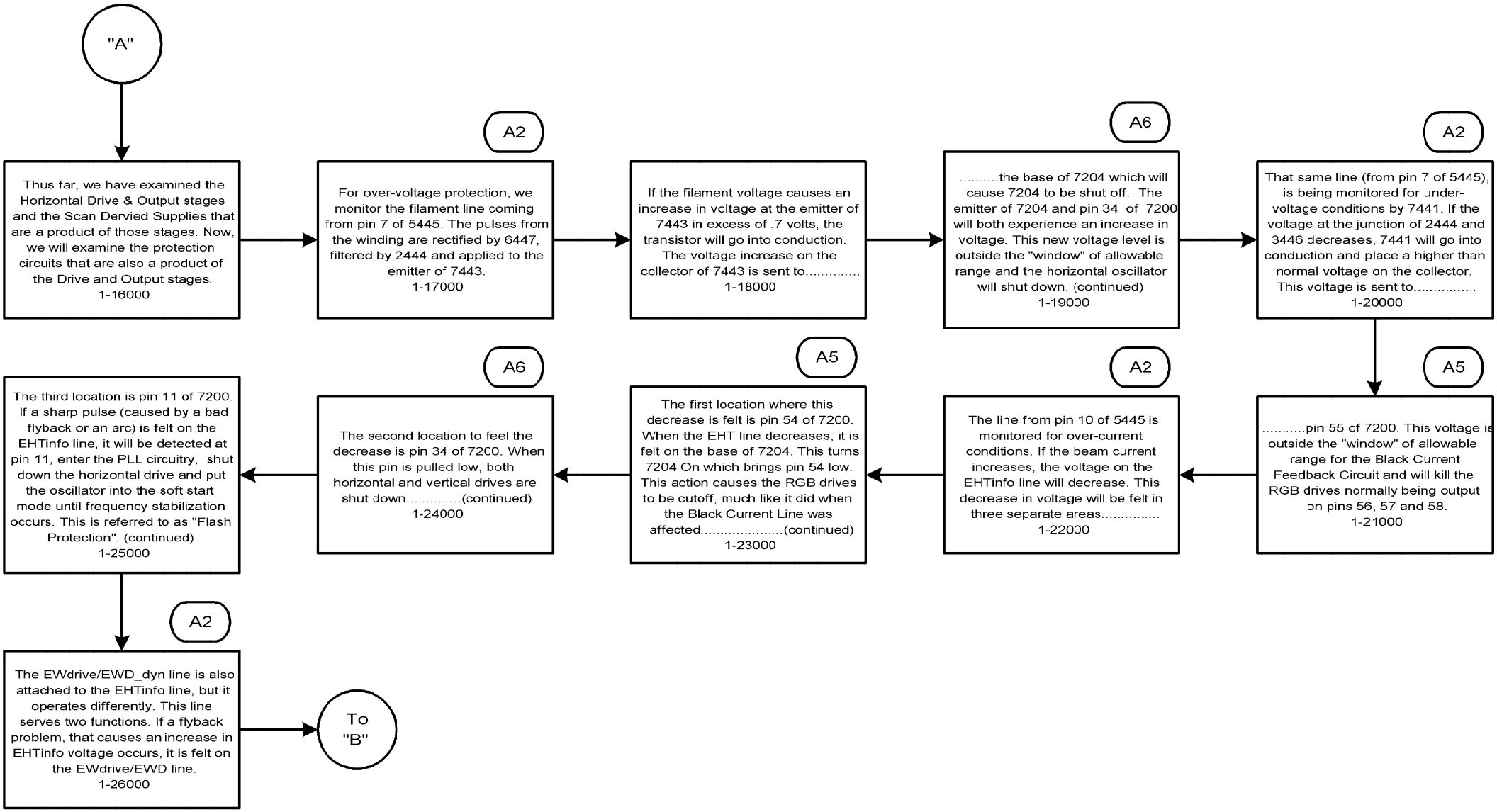
A6

The +8V and VlotAux5V supplies are sent to many places on the chassis. However, one of the most important destinations for the +8V is pin 9 of 7200. If that voltage does not come up, the horizontal oscillator will shut down which will kill the drive and all scan derived sources.
1-15000

To "A"

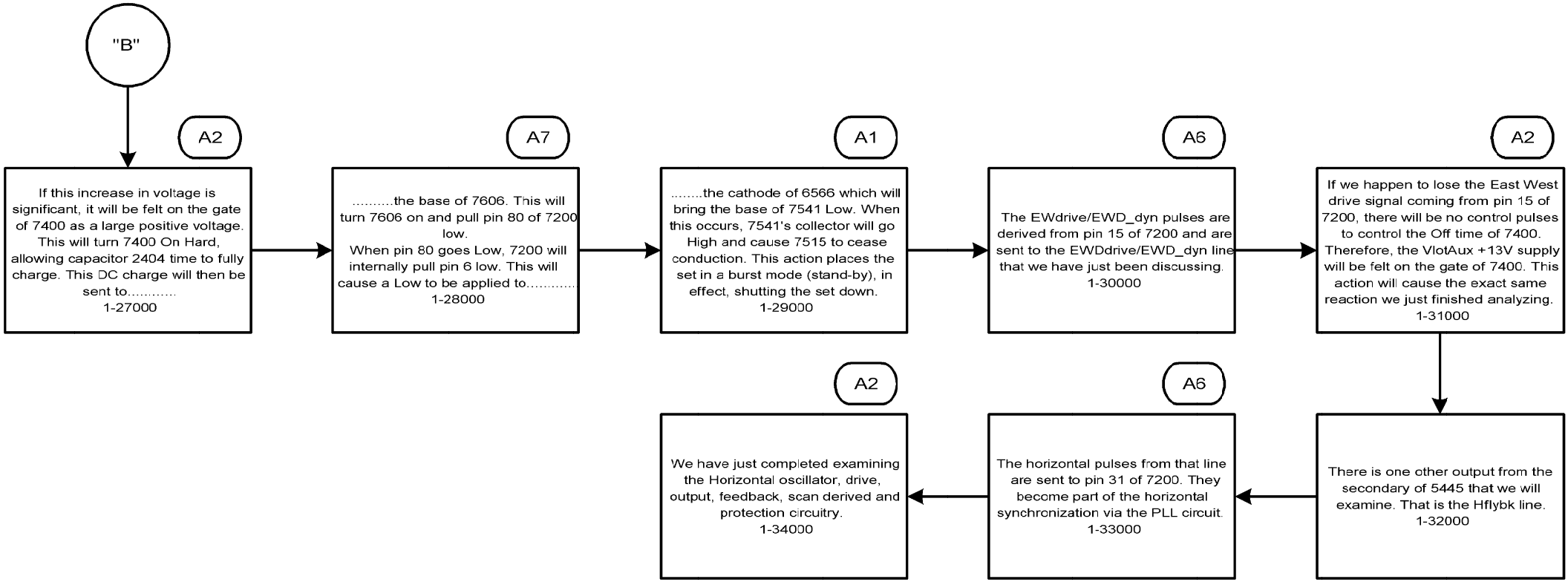
Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Horizontal 2



Note: (XX) Indicates the Schematic Page being talked about.

M-8
Generic Training
Horizontal 3



Note: (XX) Indicates the Schematic Page being talked about.

Philips Consumer Electronics

Technical Service Data

Service and Quality
Service Publications Dept.
One Philips Drive
P.O. Box 14810
Knoxville, TN 37914

Manual 7603
Model no.: 29LL600121
First Publish: 5-10-2001
Rev. Date: 9-10-2001
Print Date: 11/21/2005

Parts List

REFER TO SAFETY GUIDELINES

SAFETY NOTICE: ANY PERSON ATTEMPTING TO SERVICE THIS CHASSIS MUST FAMILIARIZE HIMSELF WITH THE CHASSIS AND BE AWARE OF THE NECESSARY SAFETY PRECAUTIONS TO BE USED WHEN SERVICING ELECTRONIC EQUIPMENT CONTAINING HIGH VOLTAGES.

CAUTION: USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING

Main Chassis

	Main Chassis	
0127	2 Pin Fuse Socket.	3122 358 71251
0136	IC-Spring, For Item 7901 (IC AN7522N).	3104 301 22081
0137	Spring For Item 7400	3139 121 24581
0138	IC-Sprting, For Item 7401.	3104 301 22081
0140	Spring For Item 7460	3139 121 24581
0141	IC-Spring For Item7330	3104 301 22081
0211	2 Pin Connector (AC Input Plug). . . .	2422 025 16269
0212	2 Pin Connector (Degaussing Plug (RED)	2422 025 16375
0219	6 Pin Connector.	2422 025 12482
0220	5 Pin Connector.	2422 025 04853
0221	4 Pin Connector.	2422 025 15503
0222	2 Pin Connector (Vertical Deflection).	2422 025 10646
0223	9 Pin Connector.	2422 026 05186
0225	10 Pin Connector	2422 026 04926
0243	6 Pin Connector.	2422 025 04854
0244	5 Pin Connector.	2422 025 04853
0245	6 Pin Connector.	2422 025 04854
0246	5 pin Connector.	2422 025 12481
0254	9 Pin CRT Socket (N-Neck).	2422 500 80067
0267	3 Pin Connector.	2412 020 00725
0269	3 Pin Connector.	2422 026 05182
1000	Tuner V+U PLL F MN ENV56D98G3. .	2422 542 90108
1002	45.75MHz Saw Filter, ...	2422 549 44327
1200	4.5MHz Ceramic Filter, ...	2422 549 40807
1500	4 Amp, 250V, Fuse (5X20)	2422 086 10905
1515	5 Amp, 12V, 1 Pin Relay, ...	2422 132 07444
1600	Tact Switch.	2422 128 02742
1601	Tact Switch.	2422 128 02742
1602	Tact Switch.	2422 128 02742
1603	Tact Switch.	2422 128 02742
1606	Tact Switch.	2422 128 02742
1660	12MHz Crystal Resonator, HC49/U A. . .	2422 543 01203
1831	18.432MHz Crystal Resonator, HC49/U A.	2422 543 00842
2004	0.047uF.,25V, Ceramic.	3198 023 04730
2005	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2006	470uF., 20%, 16V, Electrolytic	3198 025 24710
2007	0.1uF., 25V, Ceramic	3198 023 21040
2008	100uF., 20%, 25V, Electrolytic. . . .	3198 025 31010
2009	0.022uF., 50V, Ceramic	3198 017 02230
2101	0.47uF., 16V, Ceramic.	3198 017 24740
2102	22pF., 50V, Ceramic.	3198 016 02290
2103	330pF., 50V, Ceramic	3198 016 03310
2104	330pF., 50V, Ceramic	3198 016 03310
2105	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2106	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2111	22pF., 50V, Ceramic.	3198 016 02290
2112	22pF., 50V, Ceramic.	3198 016 02290
2113	22pF., 50V, Ceramic.	3198 016 02290
2121	22pF., 50V, Ceramic.	3198 016 02290
2122	330pF., 50V, Ceramic	3198 016 03310
2123	2.2uF., 10V, Ceramic	3198 017 22250
2124	330pF., 50V, Ceramic	3198 016 03310
2125	2.2uF., 10V, Ceramic	3198 017 22250
2131	330pF., 50V, Ceramic	3198 016 03310
2132	2.2uF., 10V, Ceramic	3198 017 22250
2133	330pF., 50V, Ceramic	3198 016 03310
2134	2.2uF., 10V, Ceramic	3198 017 22250
2135	22pF., 50V, Ceramic.	3198 016 02290
2136	22pF., 50V, Ceramic.	3198 016 02290
2141	330pF., 50V, Ceramic	3198 016 03310
2142	2.2uF., 20%, 50V, Electrolytic	3198 025 52280
2143	0.1uF., 50V, Ceramic	3198 017 21040
2181	22pF., 50V, Ceramic.	3198 016 02290
2184	2.2uF., 10V, Ceramic	3198 017 22250
2201	0.1uF., 25V, Ceramic	3198 023 21040
2202	0.1uF., 25V, Ceramic	3198 023 21040
2203	0.1uF., 25V, Ceramic	3198 023 21040
2204	0.1uF., 25V, Ceramic	3198 023 21040
2205	0.22uF., 25V, Ceramic.	3198 023 22240
2208	0.1uF., 25V, Ceramic	3198 023 21040
2209	4.7uF., 20%, 50V, Electrolytic	3198 025 54780
2210	1uF., 20%, 50V, Electrolytic	3198 025 51080
2211	0.47uF., 16V, Ceramic.	3198 017 24740
2213	0.022uF., 50V, Ceramic	3198 017 02230
2214	0.022uF., 50V, Ceramic	3198 017 02230
2215	0.022uF., 50V, Ceramic	3198 017 02230
2216	1000uF., 20%, 16V, Electrolytic. . . .	3198 026 21020
2217	0.022uF., 50V, Ceramic	3198 017 02230
2219	0.22uF., 25V, Ceramic.	3198 023 22240
2220	0.47uF., 10%, 50V, Metalized Polyester	3198 014 04740
2221	0.022uF., 50V, Ceramic	3198 017 02230
2241	4700pF., 50V, Ceramic.	3198 017 04720
2242	1uF., 16V, Ceramic	3198 017 21050
2243	2200pF., 50V, Ceramic.	3198 017 02220
2244	0.1uF., 10%, 50V, Metalized Polyester.	3198 014 01040
2245	0.22uF., 25V, Ceramic.	3198 023 22240
2247	1000uF., 20%, 16V, Electrolytic. . . .	3198 026 21020
2248	0.022uF., 50V, Ceramic	3198 017 02230
2249	0.022uF., 50V, Ceramic	3198 017 02230
2250	2.2uF., 20%, 50V, Electrolytic	3198 025 52280
2252	1000pF., 50V, Ceramic.	3198 016 01020
2253	1000pF., 50V, Ceramic.	3198 016 01020
2254	Zero ohm "Chip" Jumper	3198 021 90020
2330	0.1uF., 10%, 250V, Metalized Polyester	2222 368 90177
2340	10uF., 20%, 250V, Electrolytic	2020 012 93495
2341	3300pF., 500V, Ceramic	3198 019 43320
2342	0.001uF., 50V, Ceramic	3198 017 01020
2343	3300pF., 2kV, 10%, Ceramic	2020 558 90529
2344	0.1uF., 25V, Ceramic	3198 023 21040
2345	1000pF., 500V, Ceramic	3198 019 41020
2405	1000pF., 50V, Ceramic.	3198 016 01020
2441	1uF., 20%, 50V, Electrolytic	3198 025 51080
2443	0.047uF., 50V, Ceramic	3198 017 24730
2444	1uF., 20%, 50V, Electrolytic	3198 025 51080
2450	47uF., 20%, 160V, Electrolytic	2020 021 91139
2451	0.015uF., 10%, 50V, Metalized Polyeste	3198 014 01530
2455	47uF., 20%, 25V, Electrolytic.	3198 025 34790
2457	0.39uF., 5%, 250V, Metalized Polypropy lene	2022 333 00085
2458	2.2uF, 20%, 100V, Electrolytic	2020 021 91331
2459	680pF., 500V, Ceramic.	3198 019 46810
2460	100pF., 50V, Ceramic	3198 016 01010
2462	0.33uF., 10%, 50V, Metalized Polyester	3198 014 03340
2463	680pF., 2kV, 10%, Ceramic.	2020 558 90485
2465	0.011uF., 5%, 1.6kV, Metalized Polypro pylene	2020 301 90251
2471	0.1uF., 10%, 50V, Metalized Polyester.	3198 014 01040
2472	0.15uF., 10%, 50V, Metalized Polyester	3198 014 01540
2473	0.1uF., 10%, 50V, Metalized Polyester.	3198 014 01040
2474	2200pF., 50V, Ceramic.	3198 017 02220
2475	2200pF., 50V, Ceramic.	3198 017 02220
2476	4700pF., 50V, Ceramic.	3198 017 04720
2480	47uF., 20%, 25V, Electrolytic. . . .	2020 021 90586
2481	470pF., 500V, Ceramic.	3198 019 44710
2482	0.068uF., 10%, 250V, Polypropylene . .	2222 347 90234
2485	4.7uF., 20%, 250V, Electrolytic. . . .	2020 021 90856
2486	470uF., 20%, 16V, Electrolytic	2020 021 91577
2487	47uF., 20%, 50V, Electrolytic.	2020 021 90854
2488	1000uF., 20%, 16V, Electrolytic. . . .	2020 021 91049
2489	470uF., 20%, 16V, Electrolytic	2020 021 91577
2491	1000pF., 500V, Ceramic	3198 019 41020
2500	0.47uF, 20%, 275V, Metalized Polypropy lene	2022 330 00018
2501	2200pF., 1kV, Ceramic.	3198 019 52220
2502	2200pF., 1kV, Ceramic.	3198 019 52220
2503	470uF., 20%, 200V, Electrolytic. . . .	2020 024 90647
2504	2200pF., 1kV, Ceramic.	3198 019 52220
2505	2200pF., 1kV, Ceramic.	3198 019 52220
2507	470pF., 50V, Ceramic	3198 017 04710
2508	470pF., 1kV, 10%, Ceramic.	3198 019 64710
2515	1500pF., 250V, 20%, Ceramic.	2020 554 90172
2520	0.1uF., 16V, Ceramic	3198 017 01040
2521	22uF., 20%, 50V, Electrolytic.	3198 025 52290
2522	0.1uF., 16V, Ceramic	3198 017 01040
2523	1500pF., 2kV, 10%, Ceramic	2020 558 90489
2525	470pF., 50V, Ceramic	3198 017 04710
2527	2200pF., 50V, Ceramic.	3198 017 02220
2528	0.001uF., 50V, Ceramic	3198 017 01020
2540	0.01uF., 50V. Ceramic.	3198 017 01030
2560	680pF., 1kV, 10%, Ceramic.	2020 558 90472
2561	100uF., 20%, 160V, Electrolytic. . . .	2020 021 91654
2562	1000pF., 50V, Ceramic.	3198 019 11020
2563	0.1uF., 10%, 50V, Metalized Polyester.	3198 014 01040
2564	2200uF., 20%, 16V, Electrolytic. . . .	2020 012 93057
2566	470uF., 20%, 6.3V, Electrolytic. . . .	2020 012 93185
2567	47uF., 20%, 25V, Electrolytic.	3198 025 34790
2568	1uF., 20%, 50V, Electrolytic	3198 025 51080
2580	47uF., 20%, 25V, Electrolytic.	3198 025 34790
2581	22uF., 20%, 50V, Electrolytic.	3198 025 52290
2601	0.22uF., 25V, Ceramic.	3198 023 22240
2602	100pF., 50V, Ceramic	3198 016 01010
2606	1000pF., 50V, Ceramic.	3198 016 01020
2607	33pF., 50V, Ceramic.	3198 016 03390
2608	0.1uF., 25V, Ceramic	3198 023 21040
2609	33pF., 50V, Ceramic.	3198 016 03390
2611	0.1uF., 25V, Ceramic	3198 023 21040
2612	22pF., 50V, Ceramic.	3198 016 02290
2613	22pF., 50V, Ceramic.	3198 016 02290
2615	1000pF., 50V, Ceramic.	3198 016 01020
2618	0.01uF., 50V. Ceramic.	3198 017 01030
2619	1uF., 16V, Ceramic	3198 017 21050
2691	10uF., 20%, 50V, Electrolytic. . . .	3198 025 51090
2801	22uF., 20%, 50V, Electrolytic. . . .	3198 025 52290
2802	0.22uF., 25V, Ceramic.	3198 023 22240
2804	2.2uF., 10V, Ceramic	3198 017 22250
2805	2.2uF., 10V, Ceramic	3198 017 22250
2806	2.2uF., 10V, Ceramic	3198 017 22250
2831	1pF., 50V, Ceramic	3198 016 01080
2832	1pF., 50V, Ceramic	3198 016 01080
2833	47pF., 50V, Ceramic.	3198 016 04790
2834	470pF., 50V, Ceramic	3198 016 04710
2835	220pF., 50V, Ceramic	3198 016 02210

S = Safety Part Be sure to use exact replacement part.

2836	1500pF., 50V, Ceramic.	3198 017 01520
2837	4.7uF., 20%, 50V, Electrolytic	3198 025 54780
2840	0.1uF., 25V, Ceramic	3198 023 21040
2841	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2842	0.1uF., 25V, Ceramic	3198 023 21040
2843	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2844	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2845	0.1uF., 25V, Ceramic	3198 023 21040
2846	100uF., 20%, 25V, Electrolytic. . . .	3198 025 31010
2849	1000pF., 50V, Ceramic.	3198 016 01020
2850	1000pF., 50V, Ceramic.	3198 016 01020
2851	4.7uF., 10V, Ceramic	2020 552 96305
2852	1000pF., 50V, Ceramic.	3198 016 01020
2853	4.7uF., 10V, Ceramic	2020 552 96305
2854	1000pF., 50V, Ceramic.	3198 016 01020
2855	33pF., 50V, Ceramic.	3198 016 03390
2856	47pF., 50V, Ceramic.	3198 016 04790
2857	150pF., 50V, Ceramic	3198 016 01510
2860	180pF., 50V, Ceramic	3198 016 01810
2894	220pF., 50V, Ceramic	3198 016 02210
2895	560pF., 50V, Ceramic	3198 016 05610
2897	390pF., 50V, Ceramic	3198 016 03910
2898	0.01uF., 50V. Ceramic.	3198 017 01030
2902	470uF., 20%, 25V, Electrolytic	3198 026 34710
2903	1uF., 20%, 50V, Electrolytic	3198 025 51080
2904	0.47uF., 16V, Ceramic.	3198 017 24740
2905	0.001uF., 50V, Ceramic	3198 017 01020
2906	0.47uF., 16V, Ceramic.	3198 017 24740
2907	0.001uF., 50V, Ceramic	3198 017 01020
2908	10uF., 20%, 50V, Electrolytic.	3198 025 51090
2910	3300pF., 50V, Ceramic.	3198 017 03320
2911	3300pF., 50V, Ceramic.	3198 017 03320
3000	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3001	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3002	Zero ohm "Chip" Jumper	3198 021 90020
3003	1.5k, 5%	3198 021 51520
3004	8.2k, 5%	3198 021 58220
3005	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3101	68 ohm, 5%, 1/6W, Carbon	3198 011 06890
3102	1k, 5%	3198 021 51020
3103	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3104	220k, 5%	3198 021 52240
3105	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3106	220k, 5%	3198 021 52240
3111	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3112	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3113	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3114	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3115	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3116	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3121	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3122	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3123	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3124	47k, 5%.	3198 021 54730
3125	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3126	47k, 5%.	3198 021 54730
3131	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3132	47k, 5%.	3198 021 54730
3133	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3134	47k, 5%.	3198 021 54730
3135	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3136	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3137	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3138	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3141	1k, 5%, 1/6W, Carbon	3198 011 01020
3154	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3155	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3156	10k, 5%, 1/6W, Carbon.	3198 011 01030
3157	100 ohm, 5%.	3198 021 51010
3158	10k, 5%.	3198 021 51030
3159	820 ohm, 5%.	3198 021 58210
3200	390 ohm, 5%, 1/6W, Carbon.	3198 011 03910
3201	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3202	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3203	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3204	10k, 5%, 1/6W, Carbon.	3198 011 01030
3205	1k, 5%	3198 021 51020
3206	33k, 5%.	3198 021 53330
3207	1k, 5%, 1/6W, Carbon	3198 011 01020
3208	220 ohm, 5%.	3198 021 52210
3209	68 ohm, 5%	3198 021 56890
3212	470 ohm, 5%.	3198 021 54710
3213	560 ohm, 5%, 1/6W, Carbon.	3198 011 05610
3217	330k, 5%	3198 021 53340
3218	82k, 5%.	3198 021 58230
3219	2.2k, 5%	3198 021 52220
3220	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3221	560 ohm, 5%, 1/6W, Carbon.	3198 011 05610
3222	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3226	560 ohm, 5%.	3198 021 55610
3235	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3241	22k, 5%.	3198 021 52230
3242	27k, 5%.	3198 021 52730
3244	820 ohm, 5%, 1/6W, Carbon.	3198 011 08210
3245	39k, 5%.	3198 021 53930
3246	10k, 5%.	3198 021 51030
3247	680k, 5%	3198 021 56840
3248	33k, 5%.	3198 021 53330
3249	820 ohm, 5%, 1/6W, Carbon.	3198 011 08210
3250	8.2k, 5%, 1/6W, Carbon	3198 011 08220
3251	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3256	1k, 5%	3198 021 51020
3257	10Meg, 5%.	3198 021 51060
3258	100k, 5%	3198 021 51040
3259	470k, 5%	3198 021 54740
3331	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3332	1k, 20%, 1/2W, Carbon.	3198 013 01020
3333	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3334	1k, 20%, 1/2W, Carbon.	3198 013 01020
3335	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3336	1k, 20%, 1/2W, Carbon.	3198 013 01020
3340	10 ohm, 5%, Fusible Resistor, NFR25. .	2306 204 03109
3341	1 ohm, 5%, Fusible Resistor, NFR25 . .	2306 204 03108
3342	1 ohm, 5%, Fusible Resistor, NFR25 . .	2306 204 03108
3343	1.5k, 20%, 1/2W, Carbon.	3198 013 01520
3344	22 ohm, 5%, 1/6W, Carbon	3198 011 02290
3345	Voltage Dependent Resistor, 1mA/50V. .	2122 550 00152
3346	22 ohm, 5%, 1/6W, Carbon	3198 011 02290
3347	Zero ohm "Chip" Jumper	3198 021 90020
3350	Zero ohm "Chip" Jumper	3198 021 90020
3353	Zero ohm "Chip" Jumper	3198 021 90020
3441	100 ohm, 5%.	3198 021 51010
3442	6.8k, 5%	3198 021 56820
3443	1Meg, 5%	3198 021 51050
3445	15k, 5%, 1/6W, Carbon.	3198 011 01530
3446	5.6k, 5%, 1/6W, Carbon	3198 011 05620
3447	180 ohm, 5%, 1/6W, Carbon.	3198 011 01810
3448	820 ohm, 5%, 1/6W, Carbon.	3198 011 08210
3449	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3450	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3451	10 ohm, 5%, Fusible Resistor, NFR25. .	2306 204 03109
3452	35.7k, 1%, Metal Film.	2322 156 23573
3453	1k, 5%, 1/6W, Carbon	3198 011 01020
3454	24k, 1%, Metal Film.	2322 156 22403
3455	6.8 ohm, 5%, 2W, Power Resistor. . . .	3198 012 26880
3456	1k, 5%	3198 021 51020
3457	10k, 5%.	3198 021 51030
3458	1k, 5%, 1/6W, Carbon	3198 011 01020
3459	15k, 5%, 2W, Power Resistor.	3198 012 21530
3460	3.9k, 5%, 1/6W, Carbon	3198 011 03920
3463	34 ohm, 5%, 1/6W, Carbon	3198 011 03390
3465	27k, 1%, Metal Film.	2322 156 22703
3468	220 ohm, 5%, 1/6W, Carbon.	3198 011 02210
3469	3.3k, 5%, 1/6W, Carbon	3198 011 03320
3470	330k, 5%	3198 021 53340
3471	3.3 ohm, 1%, Metal Film.	2322 156 23308
3472	3.3 ohm, 1%, Metal Film.	2322 156 23308
3473	3.3 ohm, 1%, Metal Film.	2322 156 23308
3474	2.2k, 1%, Metal Film	2322 156 22202
3475	2.2k, 1%, Metal Film	2322 156 22202
3477	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3478	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3479	2.7k, 5%	3198 021 52720
3480	1.5 ohm, 5%, Carbon.	2120 101 74158
3481	12k, 1%, Metal Film.	2322 156 21203
3482	12k, 1%, Metal Film.	2322 156 21203
3484	3.9k, 5%, 1/6W, Carbon	3198 011 03920
3486	33 ohm, 5%, 3W, Power Resistor	3198 012 33390
3488	4.7 ohm, 5%, Fusible Resistor, NFR25H.	2306 207 03478
3490	8.2k, 5%, 1/6W, Carbon	3198 011 08220
3491	10k, 5%, 1/6W, Carbon.	3198 011 01030
3492	1k, 5%, 1/6W, Carbon	3198 011 01020
3493	6.8 ohm, 5%, Fusible Resistor, NFR25 .	2306 204 03688
3494	4.7 ohm, 5%, Fusible Resistor, NFR25H.	2306 207 03478
3495	22k, 5%.	3198 021 52230
3496	100k, 5%	3198 021 51040
3497	100k, 5%	3198 021 51040
3498	12k, 5%.	3198 021 51230
3500	Jumper Wire.	0322 179 00003
3501	3.3Meg, 5%	2322 242 13335
3504	3 ohm, 120V, Positive Temperature Coef ficient.	2120 661 00025
3506	1.5Meg, 5%	2322 242 13155
3507	Surge Protector DSP-301N-A21F A . . .	2422 549 43073
3510	4.7 ohm, 20%, 3.1W, Negative Temperatu re C	2122 612 00056
3519	270 ohm, 5%, 1/6W, Carbon.	3198 011 02710
3520	1.2k, 5%	3198 021 51220
3521	4.7 ohm, 5%, 1/6W, Carbon.	3198 011 04780
3522	330k, 5%	3198 021 53340
3523	100 ohm, 5%, Fusible Resistor, NFR25 .	2306 204 03101
3524	56k, 5%.	3198 021 55630
3525	1k, 5%	3198 021 51020
3526	0.1 ohm, 5%, 1W, Power Resistor. . . .	3198 012 11070

S = Safety Part Be sure to use exact replacement part.

3527	0.33 ohm, 5%, 1W, Power Resistor . . .	3198 012 13370
3528	Zero ohm "Chip" Jumper	3198 021 90020
3529	47k, 5%.	3198 021 54730
3530	10k, 5%.	3198 021 51030
3531	4.7k, 5%	3198 021 54720
3532	2.2k, 5%, Fusible Resistor, NFR25. . .	2306 204 03222
3541	470 ohm, 5%.	3198 021 54710
3542	1.5k, 5%	3198 021 51520
3543	82k, 1%, Metal Film.	2322 156 28203
3544	4.7k, 1%	2120 108 92624
3545	270k, 5%	2322 730 61274
3548	15k, 5%.	3198 021 51530
3549	470 ohm, 5%, 1/6W, Carbon.	3198 011 04710
3552	10k, 5%.	3198 021 51030
3557	1k, 5%	3198 021 51020
3560	47 ohm, 5%, 1/6W, Carbon	3198 011 04790
3561	220 ohm, 5%, 1/6W, Carbon.	3198 011 02210
3562	12k, 5%.	3198 021 51230
3563	5.6k, 5%	3198 021 55620
3564	0.1 ohm, 5%, 2W, Power Resistor. . . .	3198 012 21070
3565	330 ohm, 5%, 1W, Power Resistor. . . .	3198 012 13310
3566	2.2k, 5%	3198 021 52220
3567	1.8k, 5%	3198 021 51820
3568	8.2k, 5%	3198 021 58220
3569	5.6k, 5%	3198 021 55620
3580	47k, 5%.	3198 021 54730
3601	8.2k, 5%, 1/6W, Carbon	3198 011 08220
3603	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3604	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3605	4.7k, 5%	3198 021 54720
3606	2.2k, 5%, 1/6W, Carbon	3198 011 02220
3607	2.2k, 5%, 1/6W, Carbon	3198 011 02220
3608	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3609	1k, 5%, 1/6W, Carbon	3198 011 01020
3610	8.2k, 5%, 1/6W, Carbon	3198 011 08220
3611	100 ohm, 5%.	3198 021 51010
3618	6.8k, 5%, 1/6W, Carbon	3198 011 06820
3622	100 ohm, 5%.	3198 021 51010
3623	4.7k, 5%	3198 021 54720
3624	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3625	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3626	4.7k, 5%	3198 021 54720
3627	4.7k, 5%	3198 021 54720
3628	10k, 5%.	3198 021 51030
3630	2.2k, 5%	3198 021 52220
3632	Zero ohm "Chip" Jumper	3198 021 90020
3634	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3635	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3636	100 ohm, 5%.	3198 021 51010
3681	390 ohm, 5%.	3198 021 53910
3682	3.3k, 5%	3198 021 53320
3683	390 ohm, 5%.	3198 021 53910
3684	560 ohm, 5%.	3198 021 55610
3685	560 ohm, 5%.	3198 021 55610
3686	1.5k, 5%	3198 021 51520
3691	330 ohm, 5%.	3198 021 53310
3693	220 ohm, 5%.	3198 021 52210
3694	4.7k, 5%	3198 021 54720
3801	220 ohm, 5%, 1/6W, Carbon.	3198 011 02210
3802	1k, 5%, 1/6W, Carbon	3198 011 01020
3831	47k, 5%.	3198 021 54730
3832	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3833	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3836	1k, 5%	3198 021 51020
3837	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3838	1k, 5%	3198 021 51020
3839	100 ohm, 5%, 1/6W, Carbon.	3198 011 01010
3843	2.2k, 5%	3198 021 52220
3901	1k, 5%	3198 021 51020
3902	3.3k, 5%	3198 021 53320
3903	18k, 5%.	3198 021 51830
3904	10k, 5%.	3198 021 51030
3905	3.3k, 5%	3198 021 53320
3906	10k, 5%.	3198 021 51030
3907	8.2k, 5%	3198 021 58220
4001	Zero ohm "Chip" Jumper	3198 021 90020
4002	Zero ohm "Chip" Jumper	3198 021 90020
4181	Zero ohm "Chip" Jumper	3198 021 90020
4209	Zero ohm "Chip" Jumper	3198 021 90020
4216	Zero ohm "Chip" Jumper	3198 021 90020
4217	Zero ohm "Chip" Jumper	3198 021 90020
4401	Zero ohm "Chip" Jumper	3198 021 90020
4402	Zero ohm "Chip" Jumper	3198 021 90020
4613	Zero ohm "Chip" Jumper	3198 021 90020
4614	Zero ohm "Chip" Jumper	3198 021 90020
4615	Zero ohm "Chip" Jumper	3198 021 90020
4617	Zero ohm "Chip" Jumper	3198 021 90020
4619	Zero ohm "Chip" Jumper	3198 021 90020
4622	Zero ohm "Chip" Jumper	3198 021 90020
4623	Zero ohm "Chip" Jumper	3198 021 90020
4691	Zero ohm "Chip" Jumper	3198 021 90020
4692	Zero ohm "Chip" Jumper	3198 021 90020
4693	Zero ohm "Chip" Jumper	3198 021 90020
4801	Zero ohm "Chip" Jumper	3198 021 90020
4821	Zero ohm "Chip" Jumper	3198 021 90020
4831	Zero ohm "Chip" Jumper	3198 021 90020
4833	Zero ohm "Chip" Jumper	3198 021 90020
4835	Zero ohm "Chip" Jumper	3198 021 90020
4901	Zero ohm "Chip" Jumper	3198 021 90020
4903	Zero ohm "Chip" Jumper	3198 021 90020
4982	Zero ohm "Chip" Jumper	3198 021 90020
5001	Fixed Inductor, 5.6uH, 10%	3198 018 25680
5002	Fixed Inductor, 820nH, 10%	3198 018 18270
5201	Fixed Inductor, 6.8uH, 5%.	3198 018 16880
5202	Fixed Inductor, 10uH, 10%.	3198 018 21090
5204	Fixed Inductor Bead, 100MHz	3198 018 90020
5205	Fixed Inductor Bead, 100MHz	3198 018 90020
5206	Fixed Inductor Bead, 100MHz	3198 018 90020
5241	Fixed Inductor, 10uH, 10%.	3198 018 21090
5242	Fixed Inductor, 10uH, 5%	3198 018 11090
5342	Fixed Inductor, 22uH, 10%, LAL04. . .	2422 535 97333
5445	Transformer, USLOT+U AT2078 3128 138 2	3128 138 21401
5450	Fixed Inductor, 100MHZ	2422 535 95427
5451	Fixed Inductor, 33uH, 10%.	3198 018 73390
5452	Fixed Inductor Bead, 100MHz	3198 018 90020
5457	Linear Correction Coil, 42uH	2422 535 94865
5461	Signal Driver Transformer SC10015-00 B.	2422 531 02465
5471	Fixed Inductor, 3.3uH, 20%	3198 018 73380
5472	Fixed Inductor, 3.3uH, 10%	3198 018 23380
5480	Fixed Inductor, 39uH, 10%, LAL04 . . .	2422 535 97336
5501	AC Filter, DMF2405H60.	2422 549 43432
5520	Transformer SS39009-04.	2422 531 02459
5521	Fixed Inductor Bead, 100MHz	3198 018 90010
5560	Fixed Inductor Bead, 100MHz	3198 018 90010
5561	Fixed Inductor, 27uH, 10%.	3198 018 22790
5562	Fixed Inductor Bead, 100MHz	3198 018 90010
5564	Fixed Inductor Bead, 100MHz	3198 018 90010
5602	Fixed Inductor, 5.6uH, 5%.	3198 018 15680
5603	Fixed Inductor, 5.6uH, 5%.	3198 018 15680
5604	Fixed Inductor, 5.6uH, 5%.	3198 018 15680
5831	Fixed Inductor, 6.8uH, 5%.	3198 018 16880
5832	Fixed Inductor, 6.8uH, 5%.	3198 018 16880
5833	Fixed Inductor, 6.8uH, 5%.	3198 018 16880
5835	Fixed Inductor, 12uH, 10%.	3198 018 31290
6001	Diode Regulator, BZX79-C33 (33 Volt) .	3198 010 23390
6201	Diode, BAS316.	3198 010 10630
6202	Diode, BAS316.	3198 010 10630
6206	Diode Regulator, BZX384-C6V8 (6.8 Volt	3198 020 56880
6331	Diode, BAV21	3198 010 10070
6332	Diode, BAS316.	3198 010 10630
6333	Diode, BAV21	3198 010 10070
6335	Diode, BAV21	3198 010 10070
6444	Diode, 1N4148.	3198 010 10010
6447	Diode, 1N4148.	3198 010 10010
6448	Diode Regulator, BZX79-B6V2 (6.2 Volt)	9331 668 30133
6449	Diode, BAV99	3198 010 10620
6453	Diode Regulator, BZX384-C6V8 (6.8 Volt	3198 020 56880
6460	Diode Rectifier, BY228/24.	9340 559 50112
6461	Diode Rectifier, RGP30J-L7004.	9338 617 60682
6462	Diode Regulator, BZX79-C9V1 (9.1 Volt)	9331 177 80133
6465	Diode, BAV21	3198 010 10070
6466	Diode, BAV21	3198 010 10070
6467	Diode, BAV70	9331 849 10215
6468	Diode, BAS316.	3198 010 10630
6470	Diode, BAV99	3198 010 10620
6476	Diode Regulator, BZX79-C15 (15 Volt) .	3198 010 21590
6481	Diode Regulator, BZX79-C5V6 (5.6 Volt)	3198 010 25680
6482	Diode Regulator, BZX79-C9V1 (9.1 Volt)	9331 177 80133
6483	Diode Regulator, BZX79-C33 (33 Volt) .	3198 010 23390
6485	Diode Rectifier, BYD33J.	9337 234 20133
6486	Diode Rectifier, EGP20DL-5100.	9322 164 42682
6487	Diode Rectifier, BYD33D.	9337 234 00133
6488	Diode Rectifier, EGP20DL-5100.	9322 164 42682
6500	Bridge Rectifier GBU6JL-7002	9322 138 08667
6520	Diode Rectifier, BYD33D.	9337 234 00133
6523	Diode, 1N4148.	3198 010 10010
6525	Diode Rectifier, 1N5062.	3198 010 10120
6540	Diode Regulator, BZX79-B6V2 (6.2 Volt)	9331 668 30133
6541	Diode Regulator, BZX384-C10 (10 Volt).	3198 020 51090
6560	Diode Rectifier, BYV29X-500.	9340 555 59127
6562	Diode Rectifier, EGP20DL-5100.	9322 164 42682
6563	Diode, BAS316.	3198 010 10630
6565	Diode, BAV70	9331 849 10215
6566	Diode, 1N4148.	3198 010 10010
6569	Diode, BAS316.	3198 010 10630
6570	Diode Regulator, BZX384-C6V8 (6.8 Volt s)	3198 020 56880
6580	Diode, BAS316.	3198 010 10630
6581	Diode, BAS316.	3198 010 10630
6681	Diode, BAT85	9336 247 60133
6691	LED, LTL-10224WHCR (LITO)	9322 050 99682
6692	IR Receiver, TSOP1836UH3V(TEG)L. . . .	9322 127 54667
6831	Diode, 1N4148.	3198 010 10010

S = Safety Part Be sure to use exact replacement part.

6901	Diode, BAS316.	3198 010 10630
7101	Transistor BC847B.	3198 010 42030
7102	Transistor BC857B.	3198 010 42150
7103	Transistor BC847B.	3198 010 42030
7200	IC, TDA9587H/N1/3, 1US1 Software Clust er	9352 699 87557
7201	Transistor BC847B.	3198 010 42030
7204	Transistor BC857B.	3198 010 42150
7205	Transistor BC857B.	3198 010 42150
7330	IC, TDA6107Q/N2.	9352 576 50112
7441	Transistor BC857B.	3198 010 42150
7443	Transistor BC557B.	3198 020 40110
7450	Transistor PDTA114ET	3198 010 44010
7460	Power Transistor BU4508DX-clip 0140. .	9340 550 92127
7461	Transistor BC337-25.	3198 020 43530
7462	Transistor PDTC143ZT	9340 547 00215
7463	Transistor BC327-25.	3198 020 43430
7471	IC, TDA8359J	9352 635 76112
7480	Power Transistor BD135-16.	3198 020 41190
7482	Power Transistor BD135-16.	3198 020 41190
7515	Opto-Coupler, TCET1103(G).	9322 140 14667
7520	IC, TEA1507P/N1.	9352 673 56112
7521	Power FET, STP8NC50FP.	9322 160 72687
7522	Transistor BC847B.	3198 010 42030
7540	Transistor BC547B.	3198 020 40030
7541	Transistor PDTC114ET	9340 310 10215
7542	Transistor BC857B.	3198 010 42150
7560	IC, L78L33ACZ.	9322 134 92676
7561	Transistor PDTC143ZT	9340 547 00215
7562	Transistor BC857B.	3198 010 42150
7564	Transistor BC857B.	3198 010 42150
7580	Transistor BC857B.	3198 010 42150
7602	IC, M24C16-WBN6.	9322 147 25682
7801	IC, HEF4052BT.	9333 729 50653
7802	IC, HEF4053BT.	9333 729 60653
7831	IC, MSP3445G-PO-B8	9322 160 81682
7901	IC, AN7522N.	9322 158 65667
9101	Jumper Wire.	0322 179 00003
9102	Jumper Wire.	0322 179 00003
9103	Jumper Wire.	0322 179 00003
9181	Jumper Wire.	0322 179 00003
9424	Jumper Wire.	0322 179 00003
9696	Jumper Wire.	0322 179 00003
9849	Jumper Wire.	0322 179 00003
9903	Jumper Wire.	0322 179 00003
CBA	Main Chassis	3139 127 23141

Front I/O, Control, Headphone Panel
Front I/O, Control, Headphone Panel

PIP Panel
PIP Panel

Side A/V, Headphone Panel
Side A/V, Headphone Panel

0232	Headphone Socket	2422 026 04747
0250	3 Pin Socket	2422 026 04815
0251	3 Pin Connector.	2412 020 00725
0253	3 Pin Connector.	2422 025 16382
0254	5 Pin Connector.	2422 025 12481
0255	4 Pin Connector.	2422 025 12479
2171	470pF., 50V, Ceramic	3198 019 14710
2172	470pF., 50V, Ceramic	3198 019 14710
2173	470pF., 50V, Ceramic	3198 019 14710
2174	470pF., 50V, Ceramic	3198 019 14710
2176	470pF., 50V, Ceramic	3198 019 14710
2177	100uF., 20%, 25V, Electrolytic	3198 025 31010
2178	470pF., 50V, Ceramic	3198 019 14710
2179	100uF., 20%, 25V, Electrolytic	3198 025 31010
3150	47k, 5%, 1/6W, Carbon.	3198 011 04730
3151	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3152	47k, 5%, 1/6W, Carbon.	3198 011 04730
3153	150 ohm, 5%, 1/6W, Carbon.	3198 011 01510
3155	75 ohm, 5%, 1/6W, Carbon	3198 011 07590
3156	120 ohm, 5%, 1/6W, Carbon.	3198 011 01210
3157	120 ohm, 5%, 1/6W, Carbon.	3198 011 01210
6161	Diode Regulator, BZX79-C6V8 (6.8 Volt)	3198 010 26880
9155	Jumper Wire.	0322 179 00003

CRT Panel
CRT Panel

Top Control Panel
Top Control Panel

Model 29LL600/121 Cabinet Parts
Model 29LL600/121 Cabinet Parts

S AC01	AC Power Cord.	3135 010 04731
AC02	Anode Clip	3135 014 04471
AC03	Cabinet Back	3139 124 40512
AC04	Cabinet, Front Assembly.	3121 237 52521
AC04A	Cabinet Front (Included in Front Assy)	3139 138 12621
AC05	Chassis Guide.	3139 124 31323
AC06	Control Buttons.	3139 124 32701
S AC07	Convergence and Purity Assembly. . . .	2422 549 43385
S AC08	CRT A68AJB82X.	9301 787 60472
S AC09	Degaussing Coil.	2422 549 43967
AC10	Degaussing Coil Holder (4 used). . . .	3135 013 01651
AC11	Light Guide.	3139 124 32671
AC12	Nameplate (Not Shown).	3111 250 00571
AC13	Owner's Manual, Spanish.	3135 015 17941
REMOTE	Remote Transmitter	3139 228 86491
AC16	Speaker, 5W, 16 ohm (2 used) (Included in Front Assy)	2422 264 00371
S AC18	Yoke	3313 203 01242
AC19	Yoke Wedge (3 used).	3135 013 00311
AC21	Batteries f Remote Transmitter	9299 000 65263
AC24	Degaussing Coil Spring	3139 121 26231
AC32	Assembly Braid	3135 010 07311
AC04	Cabinet Front Assembly	3121 237 51841
AC12	Nameplate (Not Shown) (Included in Front Assy)	3139 120 01301

MODEL 29LL600/121 CBA'S
MODEL 29LL600/121 CBA'S

CBA	Side A/V-Head Phone Panel.	3139 127 27471
CBA	Main Chassis	3139 127 23141

Model 32PS60B/129 Cabinet Parts
Model 32PS60B/129 Cabinet Parts

S = Safety Part Be sure to use exact replacement part.